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## Shipping

# Title 46—SHIPPING

## Chapter I—Coast Guard, Department of the Treasury

### SUBCHAPTER E—LOAD LINES

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### Subpart 43.01—Administration

**§ 43.01–1 Establishment of load lines.**

(a) Load lines are established for merchant vessels of 150 gross tons or over in conformity with the Act of March 2, 1929, as amended (46 U.S.C. 85–85g), the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88l), or the International Load Line Convention, 1930.

(b) Load lines for merchant vessels of 150 gross tons or over shall be pursuant to the regulations in this part when such vessels:

[1] See Part 44 for load line regulations applicable to coastwise load lines for steam colliers, tugs, barges, and self-propelled barges in special services and for Great Lakes vessels making foreign and coastwise voyages.

(1) Engage in foreign voyages by sea, or arrive within the jurisdiction of the United States or her possessions from foreign voyages by sea, in both cases the Great Lakes excepted; or,

(2) Engage in coastwise voyages by sea (domestic), the Great Lakes excepted.

(c) The load line regulations for merchant vessels which engage in voyages on the Great Lakes are in Part 45 of this subchapter. The load line regulations applicable to coastwise load lines for steam colliers, barges, and self-propelled barges in special services are in Part 44 of this subchapter.

(d) With respect to the enforcement of the regulations in this subchapter, the following rulings have been made:

(1) Vessels which engage in voyages from one port or place in the United States (including Alaska and Hawaii) to another port or place in the United States, or between ports or places in the same U.S. possession, and during such voyages pass outside the line dividing inland waters from the high seas are subject to the Coastwise Load Line Act.

(2) Vessels which engage in voyages from a port or place in the United States on the Atlantic Coast or Coast of the Gulf of Mexico to a port or place in the United States on the Pacific Coast (including Alaska and Hawaii), or vice versa, are subject to the Coastwise Load Line Act.

(3) Vessels which engage in voyages from one port or place in the United States to a port or place in a possession, or vice versa, or between ports or places in two different U.S. possessions, and pass outside the line dividing inland waters from the high seas are subject to the Coastwise Load Line Act, and the International Load Line Convention, 1930.

(4) Vessels which engage in voyages from a port or place in the United States or her possessions and pass outside the line dividing inland waters from the high seas and navigate on the high seas, and then return to the same port or place are subject to the Coastwise Load Line Act.

(5) Vessels which engage in foreign voyages and pass outside the line dividing inland waters from the high seas are subject to the Act of March 2, 1929, and the International Load Line Convention, 1930.

(6) Vessels which engage in voyages from a port or place in the United States to another port or place in the United States but during such voyages stop at a foreign port or place (the Canal Zone excluded) are considered to be on foreign voyages and subject to the requirements for such voyages.

(e) In concurrence with related Canadian regulations, the waters of the St. Lawrence River west of a straight line drawn from Cap de Rosiers to West Point Anticosti Island, and west of a line along 63° W. longitude from Anticosti Island to the north shore of the St. Lawrence River shall be considered as a part of the Great Lakes.

(f) This part shall not apply to merchant vessels on foreign voyages that are being towed and which are carrying neither cargo nor passengers.

### § 43.01–5 Responsibility for administration.

(a) Under the general direction and supervision of the Secretary of the Treasury, the Commandant of the United States Coast Guard is delegated the responsibility and authority for the administration of the Act of March 2, 1929, as amended (46 U.S.C. 85–85g), the International Load Line Convention, 1930, and the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88i).

### § 43.01–10 Application of regulations.

(a) No merchant vessel of the United States of 150 gross tons or over shall proceed to sea or arrive from the high seas (Great Lakes excepted), or operate on the high seas, and no foreign merchant vessel of 150 gross tons or over shall arrive or when within the jurisdiction of the United States shall proceed to sea (Great Lakes excepted) unless such vessel is:

(1) A foreign vessel and is exempted insofar as marking and certification of marks is concerned by section 5 of the Load Line Acts and § 43.01–97.

(2) A new vessel that:

(i) Has been surveyed in accordance with the provisions of § 43.01–50;

(ii) Complies with the provisions of this part as applicable to the type of vessel dealt with;

(iii) Has been marked in accordance with the provisions of this part; and,

(iv) Has had the marks certified as correct as provided by § 43.05–30.

(3) An existing vessel that:

(i) Has been surveyed, marked, and the marks certified, either under the provisions of this part, as applicable to the type of vessel, or under one of the sets of rules particularized in § 43.40–15;

(ii) Complies, as defined for the type of vessel, with the provisions of this part in principle and also in detail, as far as is reasonable and practicable, having regard to the efficiency of (*a*) the protection of openings, (*b*) guard rails, (*c*) freeing ports, and (*d*) means of access to crews' quarters provided by the existing arrangements, fittings, and appliances on the vessel.

(iii) Where it is neither reasonable nor practicable to comply with the provisions in this part in their entirety, the assigning authority will, in each case, report to the Commandant, U. S. Coast Guard, the specific matters in which the vessel is deficient, together with such recommendations as may seem desirable. Upon receipt of this report the Commandant shall determine such addition to the freeboard as will, in the judgment of the Commandant make the vessel as safe as if it had fully complied with this part.

CROSS REFERENCE: For definition of "a new vessel," and "an existing vessel," see § 43.01–25 (a).

### § 43.01–13 Penalties for violations of load line acts.

(a) The penalties for violation of various provisions of the load line acts or the regulations established thereunder are set forth in Title 46, U.S. Code, sections 85g and 88g. The Secretary of the Treasury by Treasury Department Order 167–48 has transferred to the Commandant of the United States Coast Guard authority to assess, collect, remit or mitigate any monetary penalty imposed under these laws.

(b) The master and/or owner of a vessel that is operated, navigated, or used in violation of the provisions of the Act of March 2, 1929, as amended (46 U.S.C. 85–85g), or the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88i), or the regulations in this part, will be subject to the penalties as set forth in law, and the vessel shall also be liable therefor. Depending upon the gravity of the violation, the Coast Guard may initiate any one or more of the following actions:

(1) Detain a vessel if deemed to be overloaded in violation of Title 46, U.S. Code, section 85c or 88c, in accordance with section 85f or 88f, and have the vessel surveyed by three disinterested surveyors.

(2) Assess and collect applicable monetary penalties for certain violations as provided in Title 46, U.S. Code, sections 85g and 88g.

(3) Initiate criminal prosecution for certain violations when required by Title 46, U.S. Code, section 85g or 88g.

(4) If there is a failure to pay monetary penalties assessed, initiate action of libel against the vessel involved.

(5) In addition to the foregoing actions described in this paragraph, any officer or seaman holding a valid Coast Guard license or merchant mariner's document and who may violate any provision of the Act of March 2, 1929, as amended (46 U.S.C. 85–85g), the International Load Line Convention, 1930, or the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88i), or the regulations in this part, may be subject to proceedings seeking the suspension or revocation of such person's license or document under the provisions of Title 46, U.S. Code, section 239, and the regulations prescribed thereunder in Part 137 of Subchapter K (Marine Investigations and Suspension and Revocation Proceedings) of this chapter.

(6) In determining offenses the provisions of Title 46, U.S. Code, sections 85g and 88g, also provide that "Each day a vessel is in violation of this act it constitutes a separate offense."

(c) The procedures governing the assessment, collection, remission and mitigation of any monetary penalty imposed under Title 46, U.S. Code, section 85g or 88g, for a violation of either load line law or the applicable regulations in this part, as well as the appeal procedures to be followed, are in Subpart 2.50 of Part 2 of Subchapter A (Procedures Applicable to the Public) of this chapter.

### § 43.01–15 Timber cargoes.

(a) A steamer (other than a tanker or a vessel assigned load lines on a tanker basis) which has been surveyed and marked as provided by §§ 43.01–10, 43.05–1—43.15–97, may on application by

the owner be surveyed and marked with timber load lines applicable only when carrying timber deck cargoes, and the steamer when carrying a deck cargo complying with the provisions of §§ 43.25–5 to 43.25–70, may be loaded to the timber load line as determined by this part applicable to the voyage if being:

(1) A new steamer, it complies with the conditions and provisions prescribed in §§ 43.25–5—43.25–70.

(2) An existing steamer (other than one defined in § 43.01–15) if it complies with the conditions and provisions of §§ 43.25–5—43.25–70, (other than § 43.25–15), but the vessel shall comply in principle, so far as is reasonable and practicable, with the conditions and provisions prescribed by § 43.25–15: *Provided*, That in assigning a timber load line to an existing steamer there shall be made such additions to the freeboard as shall be reasonable, having regard to the extent to which such steamer falls short of full compliance with the conditions and provisions prescribed in § 43.25–15.

(b) Existing vessels propelled by either sail or steam which have been specially constructed to carry complete cargoes of timber (that is, of the lumber schooner type) when carrying a complete cargo of timber will be marked with a load line. This load line will be applicable to all seasons and zones, and the assignment of and the certification of the load line will be made after consideration of the vessel's experience in similar voyages and of the condition of the vessel and her appliances. The conditions of assignment as required by §§ 43.25–5—43.25–70, are to be complied with so far as is reasonable and practicable. The Commandant, U. S. Coast Guard, shall approve the assignment of a load line for vessels of this type when such line is determined by experience.

(c) Existing steamers which have been specially constructed to carry complete cargoes of timber (that is, steam lumber schooner type) will be surveyed and marked and the marks certified in accordance with the conditions and provisions of §§ 43.01–10, 43.05–1—43.15–97, and these marks will be applicable when the steamers are engaged on voyages laden with a cargo other than a complete timber cargo.

(d) Existing sailing vessels of the lumber schooner type will be surveyed and marked and the marks certified in accordance with the conditions and provisions of §§ 43.01–10, 43.20–1—43.20–45, and these marks will be applicable when engaged on a voyage laden with cargo other than a complete timber cargo.

CROSS REFERENCE: For approval of Commandant, U. S. Coast Guard, see § 43.01–100.

### § 43.01–20 Tankers.

(a) A steamer specially constructed for the carriage of liquid cargoes in bulk, which has been surveyed as provided by § 43.01–10, shall be marked with tanker load lines and the marks certified as correct if being:

(1) A new vessel, it complies with the conditions and provisions prescribed in §§ 43.30–1—43.30–75.

(2) An existing vessel, it complies with the conditions and provisions in §§ 43.30–5, 43.30–20—43.30–35, and, also in principle so far as is reasonable and practicable with §§ 43.30–10, 43.30–15, 43.30–40, providing that in assigning a tanker load line to an existing vessel such additions to the freeboard shall be made as is reasonable, having regard to the extent to which the vessel falls short of full compliance with the conditions and provisions prescribed in §§ 43.30–10, 43.30–15, and 43.30–40.

### § 43.01–25 New and existing vessels.

(a) For the purpose of marking and certification of load lines on the international form, a "new vessel" is one whose keel was laid on or after July 1, 1932, all other vessels being regarded as existing vessels.

(b) For the purpose of marking and certification of load lines on the coastwise form, a "new vessel" is one whose keel was laid:

(1) If of 4,000 gross tons and over, on or after November 27, 1935.

(2) If less than 4,000 gross tons, on or after August 27, 1936.

(3) All other vessels being regarded as existing vessels.

### § 43.01–30 Vessels of special type.

(a) For steamers over 300 feet in length possessing constructional features similar to those of a tanker which afford extra invulnerability against the sea, a reduction in freeboard from that determined under §§ 43.15–1—43.15–97, may be granted.

(b) The amount of such reduction shall be determined by the assigning authority in relation to the freeboard assigned to tankers, having regard to the degree of compliance with the condition of assignment laid down for these vessels and the degree of subdivision provided. The freeboard assigned to such a vessel shall in no case be less than would be assigned to the vessel as a tanker.

(c) Before assignment or certification of the load lines for vessels of special type, the approval of the Commandant, U. S. Coast Guard, shall be obtained.

CROSS REFERENCE: For approval of the Commandant, U. S. Coast Guard, see § 43.01–100.

### § 43.01–32 Stability.

(a) The rules of this part necessarily assume that the nature and stowage of the cargo, ballast, etc., are such as to secure sufficient stability for the vessel.

(b) Having regard for the fact that certain vessels, such as those carrying all their cargo as deck cargo, may need to have the amount of cargo and resulting draft limited by stability considerations, the load line assignments of vessels, which are subject to the stability test requirements contained in § 31.10–30 in Subchapter D (Tank Vessels) or in Subpart 93.05 in Subchapter I (Cargo and Miscellaneous Vessels) of this chapter, shall in no case be deeper than permitted by the results of such tests.

(c) Load line assignments to vessels not subject to inspection will also be made subject to the results of a stability test if the design and service of the vessels are such as to indicate the need for a draft limitation based thereon.

(d) Load line assignments made to vessels before the results of stability tests are known shall be regarded as conditional and subject to verification by the Commandant.

### § 43.01–35 Marks to indicate load lines.

(a) Marks to indicate the maximum mean drafts to which a vessel can be lawfully submerged, in the various circumstances and seasons, shall be permanently marked on each side of the vessel in the form, manner, and location provided by this part.

### § 43.01–40 Assignment and certification; assigning authority.

(a) The American Bureau of Shipping is appointed to assign load lines and to determine whether the position of and the manner of marking each vessel has been performed in accordance with this part and the applicable provisions in the Act of March 2, 1929, as amended (46 U.S.C. 85–85g), or the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88i). The American Bureau of Shipping is authorized to issue a load line certificate, certifying to the correctness of the marks, under its own hand and seal. Its mailing address is American Bureau of Shipping, 45 Broad Street, New York, N.Y., 10004.

(1) As provided in section 3 of the Act of March 2, 1929, as amended (46 U.S.C. 85b), and section 3 of the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88b), the Commandant, United States Coast Guard, may, at the request of a shipowner, appoint any other recognized classification society which he may approve, as the load line assigning authority.

(2) The American Bureau of Shipping, or other approved load line assigning agency, is authorized to renew from time to time by endorsement a load line certificate.

(3) Load line certificates will not be issued until the load line marks have been verified. This certificate will be issued in duplicate, one copy being delivered to the owner or master of the vessel and one copy, together with a summary of the data used to determine the load line, will be forwarded to the Commandant, United States Coast Guard, Washington, D.C., 20226. Each new vessel, after January 1, 1948, when receiving its first load line certificate, shall be also furnished a copy of the load line survey report, which shall be retained on board the vessel for the information of inspectors and surveyors when carrying out subsequent load line surveys.

(b) As referred to in this subchapter, the term "assigning authority" or "American Bureau of Shipping" shall refer either to that society or to such other society as may have been specifically approved by the Commandant as a load line assigning authority for the vessel concerned.

(c) The scale of maximum fees payable to the assigning authority for this service is contained in § 43.40–5.

§ 43.01–50 Surveys.

(a) *Steel vessels.* (1) The vessel is to be placed in drydock to determine the condition of the hull plating, etc.

(2) The holds, 'tween decks, peaks, bilges, engine and boiler spaces, and bunkers are to be examined to determine the condition of the framing, etc.

(3) Deep tanks and other tanks which form part of the vessel are to be examined internally.

(4) Where a double bottom is fitted, the tanks are to be examined internally. Where double bottom and other tanks are used for fuel-oil bunkers, such tanks need not be cleaned out, provided the surveyors are able to determine by an external examination that their general condition is satisfactory.

(5) The decks are to be examined.

(6) The hatch covers, hatch beams, and fore-and-afters, tarpaulins, battens and wedges, the hatchway and ventilator coamings, companionways, the engine and boiler casings, the superstructures on the freeboard deck, and all means of protecting the openings in the freeboard deck and superstructures and bulkheads are to be examined.

(7) All air pipe outlets, scuppers, sanitary discharges in the vessel's sides, and air ports are to be examined.

(8) All gangways, cargo, and coaling ports or other similar openings in vessel's sides are to be examined.

(9) Guard rails, gangways, and shutters in freeing ports are to be examined.

(10) All eye plates or similar fittings for timber deck cargo lashings and sockets for uprights are to be examined.

(11) Where, owing to the age and condition of the vessel, the surveyors deem it necessary, the shell and deck plating may be required to be drilled in order to ascertain the then thickness of such plating.

(b) *Wood vessels.* (1) The vessel is to be placed on a drydock or a slip way and the keel, stem, stern frame or stern post and outside planking are to be examined. Caulking is to be tried at such places about the planking as deemed necessary by the surveyors.

(2) Careful examination must be made for faulty fastenings and such bolts or treenails must be backed out, or otherwise dealt with, as may be deemed necessary by the surveyors.

(3) Careful examination is to be made of the entire structure and if considered necessary borings are to be made to ascertain the conditions of the materials; should these disclose cause for further examination, listings are to be made where required to satisfy the surveyors as to the true condition of the vessel.

(4) The holds, 'tween decks, peaks, bilges, engine and boiler spaces, and bunkers are to be examined.

(5) The decks are to be examined and bored where necessary.

(6) The hatch covers, hatch beams, fore-and-afters, tarpaulins, battens and wedges, the hatchway and ventilator coamings, companionways, the engine and boiler casings, the superstructures on the freeboard deck, and all means of protecting the openings in the freeboard deck and superstructures and bulkheads are to be examined.

(7) All air pipe outlets, scuppers, sanitary discharges in the vessel's sides, and air ports are to be examined.

(8) All gangways, cargo, and coaling ports or other similar fittings in the vessel's sides are to be examined.

(9) Guard rails, gangways, and shutters in freeing ports are to be examined.

(10) All eye plates or similar fittings for timber deck cargo lashings and sockets for uprights are to be examined.

(c) *Correction of deficiencies.* (1) Any such parts or fittings of the vessel as are found to be in an unsatisfactory condition are to be repaired or renewed in order to place the vessel in a seaworthy condition so as to be eligible for a load line certificate.

§ 43.01–55 Annual inspection.

(a) A vessel having been marked as provided by this part, and the mark certified as correct, will be inspected at intervals of approximately 12 months in order to insure the maintenance in an effective condition of the fittings and appliances for the:

(1) Protection of openings,

(2) guard rails,

(3) freeing ports,

(4) means of access to crews' quarters, and

(5) that there have not been alterations made to the hull or superstructures which would affect the calculations determining the position of the load lines.

(b) The American Bureau of Shipping is appointed to make this inspection and to report thereon to the owners of the vessel, a copy of this report being forwarded to the Commandant, U. S. Coast Guard, Washington, D.C., 20226.

(c) The scale of fees payable to the American Bureau of Shipping for this service is contained in § 43.40–5.

§ 43.01–60 Application for assignment, renewal, and certification.

(a) Application for assignment and certification of load line marks or for renewal of load line certificates shall be made in writing to the American Bureau of Shipping by the owners of the vessel.

(b) Application for the assignment of load lines to a foreign vessel belonging either to a country ratifying the International Load Line Convention, 1930, or to a country with which the United States has reciprocal load line agreement in effect shall be made by the Government to which the vessel belongs, otherwise load lines shall not be assigned such a vessel under this part.

§ 43.01–65 Application for annual inspection.

(a) Application for annual load line inspection required by § 43.01–55 shall be made in writing to the American Bureau of Shipping by the owners of a vessel.

§ 43.01–70 Equivalents.

(a) Where in this part it is provided that a particular fitting or appliance, or type thereof, shall be fitted or carried in a vessel, or that any particular arrangement shall be adopted, there may be substituted any other fitting or appliance or type thereof, or any other arrangement: *Provided,* That such fitting, appliance or arrangement shall be considered a suitable equivalent by the assigning authority and the approval of the Commandant, U.S. Coast Guard, for such substitution shall have been issued.

CROSS REFERENCE: For approval of Commandant, U. S. Coast Guard, see § 43.01–100.

§ 43.01–75 Validity and renewal of certificates.

(a) As the assignment of load lines is conditioned upon the structural efficiency of the vessel and upon the provision of effective protection to vessel and crew, every vessel required to be marked by the Act of March 2, 1929, as amended (46 U.S.C. 85–85g), and Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88i), with load lines shall be surveyed by the assigning authority at least once in each 5 years to determine that the load lines are then correctly placed as required by this part. If the load line mark be found correct for the vessel in the condition she is then in, the certificate shall be renewed for such time as the condition of the vessel then warrants, but in no case for a longer period than 5 years and the facts shall be attested by endorsement upon the back of the certificate in the form shown in § 43.40–10.

(b) Foreign vessels belonging to countries which have not ratified the Load Line Convention and which have not been exempted pursuant to section 5 of the Load Line Act (45 Stat. 1493; 46 U. S. C. 85d) shall have their load line certificate limited to a period of 1 year. The certificate may be validated for additional 1-year periods: *Provided,* That the condition of the vessel then warrants, and the facts are attested by endorsement upon the back of the load line certificate by a surveyor of the American Bureau of Shipping or of the classification society issuing the certificate. The certificate will become void 5 years from date of issue, or at the expiration of the fourth yearly validation, whichever occurs first.

(c) The Commandant, U. S. Coast Guard, shall be notified of every renewal indorsement and the date of its expiration.

§ 43.01–80 Forms of certificates.

(a) The form of certificate certifying to the correctness of the load line mark assigned under the regulations in this part shall be as shown in § 43.40–10, as follows:

(1) International load line certificate issued to United States vessels engaged in foreign voyages, applicable as stated:

(i) Form A1 for general use.

(ii) Form A2 for sailing vessels.

(iii) Form A3, general use combined with timber deck cargo.

(2) For foreign vessels belonging to countries that have not ratified or acceded to the International Load Line Convention, 1930:

(i) Form B for general use.

(3) Coastwise load line certificate issued to United States vessels engaged

solely in coastwise voyages (other than special services provided for by Part 44 of this subchapter).

(i) Form C1 for general use.

(ii) Form C 3 for sailing ships.

(iii) Form C3, general use combined with timber deck cargo.

(iv) Form C4 for certain vessels above 300 feet in length in United States coastwise and/or intercoastal service.

(b) The assigning authority may provide forms similar to the above, these forms to be approved by the Commandant, U. S. Coast Guard, before being issued.

CROSS REFERENCE: For forms of load line certificates, see §§ 43.40–10, 44.05–35 of this subchapter.

§ 43.01–85 Cancellation of certificate.

(a) Notwithstanding the marking of a load line and the issuance of a load line certificate, the certificate will be canceled if:

(1) The annual load line inspection required by § 43.01–55 has not been carried out or that the items described under § 43.01–55 (a) (1), (2), (3), and (4) are not maintained in an effective condition.

(2) The survey required by § 43.01–50 has not been carried out or that any defects disclosed by the survey have not been corrected.

(3) Due to any cause the conditions of assignment have not been maintained as provided by this part, or alterations have been made to hull or superstructures which affect the calculations made to determine the location of the load line.

§ 43.01–90 Zones and seasonal areas.

(a) A vessel coming under the provisions of the Act of March 2, 1929, as amended (46 U.S.C. 85–85g), or the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88i), shall conform to the conditions applicable to the zones and seasonal areas as described in this part.

(b) A port located on the boundary line between two zones shall be regarded as within the zone from which the vessel arrived or into which the vessel departs.

(c) No vessel to which these acts apply shall be loaded so as to submerge the load line then applicable to her voyage. When loading a vessel in a favorable zone for a voyage on which the vessel will enter a less favorable zone, such allowance must be made that the vessel, when crossing into the less favorable zone, will conform to the regulations and freeboard for the less favorable zone.

§ 43.01–95 Logbook entries.

(a) It is the master's responsibility to have entered in the vessel's "Official Logbook" if carried, otherwise in a log considered as its official logbook, the data required by section 6 of the Act of March 2, 1929, as amended (46 U.S.C. 85e), or section 6 of the Coastwise Load Line Act of 1935, as amended (46 U.S.C. 88e). These logbook entries shall be made before a vessel departs from her loading port or place and consist of:

(1) A statement of the load line marks applicable to the voyage;

(2) A statement of the position of the load line mark, port and starboard, at the time of departing from a port or place; and,

(3) The actual drafts of the vessel, forward and aft, as nearly as the same can be ascertained, at the time of departing from a port or place.

§ 43.01–97 Control.

(a) The Collector of Customs or the Coast Guard District Commander may detain a vessel for survey if there is reason to believe that the vessel is proceeding on her journey in excess of the draft allowed by the regulations in this part as indicated by the vessel's load line certificate, or otherwise. The Coast Guard District Commander may detain a vessel if it is so loaded as to be manifestly unsafe to proceed to sea.

(b) If the Collector of Customs orders a vessel detained, he shall immediately inform the Coast Guard District Commander thereof, who shall thereupon advise the Collector of Customs whether or not he deems that the vessel may proceed to sea with safety. If the Coast Guard District Commander orders a vessel detained, such officer will furnish the Collector of Customs immediate notification of such detention. The clearance shall be refused to any vessel which shall have been ordered detained, which shall be in effect until it is shown that the vessel is not in violation of the applicable law and the regulations in this part.

(c) The detention of a vessel will be by written order of either the Coast Guard District Commander or the Collector of Customs, depending on who orders the detention. The detaining officer will immediately arrange for a survey in the manner prescribed by either section 7 of the Act of March 2, 1929, as amended (46 U.S.C. 85f), or section 7 of the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88f), whichever may be applicable in a particular case. Unless the owner or agent waives in writing and stipulates to accept the Coast Guard's survey, the detaining officer shall appoint three disinterested surveyors and, where practicable, one of them shall be from the Surveying Staff of the American Bureau of Shipping. Such surveyors shall conduct a survey to ascertain whether or not the vessel is loaded in violation of the applicable provisions in the Act of March 2, 1929, as amended (46 U.S.C. 85–85g), or the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88i), and the regulations in this part. If the survey confirms the allegation that the vessel is in violation of either law or the regulations in this part, "the owner and agent shall bear the costs of the survey in addition to any penalty or fine imposed," as provided in these laws. Where such surveyors are appointed by the Collector of Customs, such appointment shall be with the approval of the Coast Guard District Commander.

(d) Whenever a vessel is detained, the master or owner may, within five days, appeal to the Commandant, United States Coast Guard, who may, if he desires, order a further survey, and may affirm, set aside, or modify the order of the detaining officer.

(e) Where a foreign vessel is detained, or any action is taken which would appear likely to result in legal proceedings being taken against such a vessel, the consul of the country to which the vessel belongs shall be informed as soon as possible of the circumstances of the case.

(f) Pursuant to the provisions of section 5 of the Act of March 2, 1929, as amended (46 U.S.C. 85d), and section 5 of the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88d), it is hereby certified that a vessel of a foreign country which has ratified the International Load Line Convention, 1930, shall be deemed a vessel of a foreign country as described in section 5 of these acts, and such a vessel shall be exempt from the provisions of the regulations in this part insofar as the marking of the load lines and the certificating thereof are concerned, only so long as such country similarly recognizes the load lines established by the regulations in this part, for the purpose of a voyage by sea: *Provided*, That the vessel is marked with load lines and has on board a valid load line certificate certifying to the correctness of the mark, the vessel shall not be loaded beyond the limits allowed by the certificate, the position of the load line of the vessel shall correspond with the certificate, the hull and superstructure shall not have been so materially altered as to affect the calculations on which the load line was based, and alterations have not been made so that the protection of openings, guardrails, freeing ports, and means of access to crew's quarters, have made the vessel manifestly unfit to proceed to sea without danger to human life.

§ 43.01–100 Approval of Commandant, U.S. Coast Guard.

(a) Where the active approval of the Commandant, U.S. Coast Guard is required in connection with this part, such information as will enable the Commandant, to obtain a comprehensive understanding of the question at issue shall be furnished and will remain with the Commandant, as a record.

## Subpart 43.05—General Rules for Determining Maximum Load Lines of Merchant Vessels

§ 43.05–1 Definitions.

(a) *Steamer.* (1) The term "steamer" or "steamship" includes all vessels hav-

ing sufficient means for mechanical propulsion, except where provided with sufficient sail area for navigation under sails alone.

(2) A vessel fitted with mechanical means of propulsion and with sail area insufficient for navigation under sails alone may be assigned a load line under §§ 43.15–1—43.15–97.

(3) A lighter, barge, or other vessel without independent means of propulsion, when towed, is to be assigned a load line under §§ 43.15–1—43.15–97.

(b) *Sailing vessel.* The term "sailing vessel" includes all vessels provided with sufficient sail area for navigation under sails alone, whether or not fitted with mechanical means of propulsion.

(c) *Flush-deck vessel.* A flush-deck vessel is one which has no superstructure on the freeboard deck.

(d) *Superstructure.* A superstructure is a decked structure on the freeboard deck extending from side to side of the vessel. A raised quarter-deck is considered a superstructure.

(e) *Load line.* The load line is the line defining the maximum mean draft to which a vessel may be lawfully submerged. It is the lower limit of the freeboard as determined by the regulations in this part having regard to the various conditions and seasons.

(f) *Freeboard.* The freeboard assigned is the distance measured vertically downward at the side of the vessel amidships from the upper edge of the deck line to the upper edge of the load line.

(g) *Freeboard deck.* The freeboard deck is the deck from which the freeboard is measured, and is the uppermost complete deck having permanent means of closing all openings in weather portions of the deck in accordance with §§ 43.10–1—43.10–45. It is the upper deck in flush-deck vessels and vessels with detached superstructures. In vessels having discontinuous freeboard decks within superstructures which are not intact, or which are not fitted with class 1 closing appliances, the lowest line of the deck below the superstructure deck is taken as the freeboard deck.

(h) *Amidships.* Amidships is the middle of the length of the summer load waterline, as defined in § 43.15–1.

### § 43.05–5 Deck line.

(a) The deck line is a horizontal line 12 inches in length and 1 inch in breadth. It is to be marked amidships on each side of the vessel, and its upper edge is to pass through the point where the continuation outward of the upper surface of the freeboard deck intersects the outer surface of the shell. (See fig. 43.05–5(a).) Where the deck is partly sheathed amidships, the upper edge of the deck line is to pass through the point where the continuation outward of the upper surface of the actual sheathing at amidships intersects the outer surface of the shell.

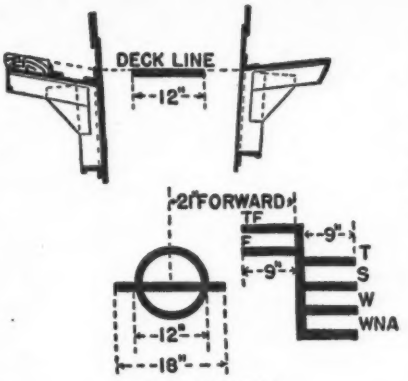



FIGURE 43.05–5(a)

### § 43.05–10 Load line disk.

(a) The load line disk is 12 inches in diameter and is intersected by a horizontal line 18 inches in length and 1 inch in breadth, the upper edge of which passes through the center of the disk. The disk is to be marked amidships below the deck line.

### § 43.05–15 Lines used with disk.

(a) The lines which indicate the maximum load line in different circumstances and in different seasons (see § 43.40–1) are to be horizontal lines, 9 inches in length and 1 inch in breadth, which extend from, and are at right angles to, a vertical line marked 21 inches forward of the center of the disk, except as provided otherwise in paragraph (d) of this section. (See Figure 43.05–5(a).)

(b) The following are the lines to be used:

(1) *Summer load line.* The summer load line is indicated by the upper edge of the line which passes through the center of the disk and also by a line marked "S."

(2) *Winter load line.* The winter load line is indicated by the upper edge of a line marked "W."

(3) *Winter North Atlantic load line.* The winter North Atlantic load line is indicated by the upper edge of a line marked "WNA."

(4) *Tropical load line.* The tropical load line is indicated by the upper edge of a line marked "T."

(5) *Fresh-water load lines.* The fresh-water load line in summer is indicated by the upper edge of a line marked "F." The difference between the fresh-water load line in summer and the summer load line is the allowance to be made for loading in fresh water at the other load lines. The tropical fresh-water load line is indicated by the upper edge of a line marked "TF."[3] (This provision for deeper loading in fresh water is not applicable to the Great Lakes.)

[3] Where seagoing steamers navigate a river or inland water, deeper loading is permitted corresponding to the weight of fuel, etc., required for consumption between the point of departure and the open sea.

(c) Where the draft is restricted on a basis of subdivision or stability and this draft is less than any of the various seasonal drafts permitted by this part the center of the disk shall be located on the line of this restricted draft and it shall be applicable to all zones and seasons. If such a permissible maximum draft comes between the seasonal markings, the seasonal markings below shall also be added. A fresh-water load line may be marked forward of the disk as provided in this section.

(d) Domestic vessels eligible for operation at the freeboards indicated by §§ 43.15–87(b), 43.15–90(b), 43.15–98(a), or 43.30–1(b) shall have the related winter, summer, tropical, fresh, and tropical fresh water marks located abaft the disk and surmounted by the letter "C". (See Figure 43.05–15(d).) While a complete set of additional marks is shown by this Figure, vessels also marked forward of the disk in accordance with § 43.05–5(a) need show abaft the disk only those additional marks which are necessary. Vessels departing on foreign voyages shall only bear the load line marks forward of the disk marked in accordance with § 43.05–5(a).

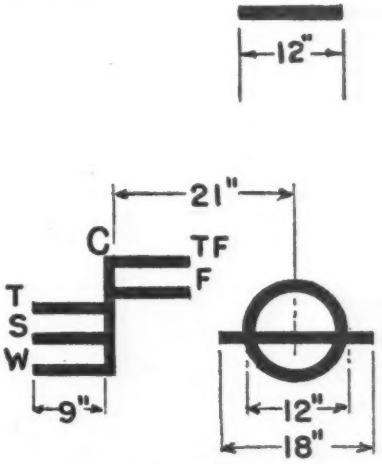



FIGURE 43.05–15(d)

### § 43.05–20 Mark of assigning authority.

(a) The authority by whom the load lines are assigned may be indicated by letters measuring about 4½ by 3 inches marked alongside the disk and above the centerline.

### § 43.05–25 Details of marking.

(a) The disk, lines, and letters are to be painted in white or yellow on a dark ground or in black on a light ground. They are also to be carefully cut in or center punched on the sides of iron and steel vessels, and on wood vessels they are to be cut into the planking for at least one-eighth of an inch. The marks are to be plainly visible, and, if necessary, special arrangements are to be made for this purpose.

§ 43.05–30 Verification of marks.

(a) The load lines certificate is not to be delivered to the vessel until a surveyor of the assigning authority has certified that the marks are correctly and permanently indicated on the vessel's side.

## Subpart 43.10—Conditions of Assignment of Load Lines

§ 43.10–1 Construction of vessel.

(a) The assignment of load lines is conditional upon the vessel being structurally efficient and upon the provision of effective protection to vessel and crew.

(b) Sections 43.10–1—43.10–100 apply to vessels to which minimum freeboards are assigned. In vessels to which greater freeboards than the minimum are assigned, the protection is to be relatively as effective.

(c) Passenger vessels; subdivision and stability load lines: Where in passenger vessels the position of the maximum load lines is determined by the application of subdivision and stability regulations as provided in Part 46 of this subchapter the provisions of this part shall also be effective insofar as they are applicable.

§ 43.10–5 Cargo and other hatchways not protected by superstructures.

(a) The construction and fitting of cargo and other hatchways in exposed positions on freeboard and superstructure decks are to be at least equivalent to the standards laid down in § 43.10–10—43.10–45.

(b) Where hatch covers are of adequate metal construction, sealed watertight against pliable gaskets by dogs or other suitable means, as approved by the Load Line Assigning Authority, the application of the requirements of §§ 43.10–10—43.10–45 will be modified accordingly.

§ 43.10–10 Hatchway coamings.

(a) The height of hatchway coamings on freeboard decks is to be at least 24 inches above the deck. The height of coamings on superstructure decks is to be at least 24 inches above the deck if situated within a quarter of the ship's length from the stem, and at least 18 inches if situated elsewhere.

(b) Coamings are to be of steel, are to be substantially constructed and, where required to be 24 inches high, are to be fitted with an efficient horizontal stiffener placed not lower than 10 inches below the upper edge, and fitted with efficient brackets or stays from the stiffener to the deck, at intervals of not more than 10 feet. Where end coamings are protected, the requirements of this section may be modified.

§ 43.10–15 Hatchway covers.

(a) Covers to exposed hatchways are to be efficient, and where they are made of wood, the finished thickness is to be at least 2⅜ inches in association with a span of not more than 5 feet. The width of each bearing surface for these hatchway covers is to be at least 2½ inches.

§ 43.10–20 Hatchway beams and fore-and-afters.

(a) Where wood hatchway covers are fitted the hatchway beams and fore-and-afters are to be of the scantlings and spacing given in Table 43.10–20 (a1) where coamings 24 inches high are required, and as given in Table 43.10–20 (a2) where coamings 18 inches high are required. Angle bar mountings on the upper edge are to extend continuously for the full length of each beam. Wood fore-and-afters are to be steel shod at all bearing surfaces.

TABLE 43.10-20 (a1)—HATCHWAY BEAMS AND FORE-AND-AFTERS FOR VESSELS 200 FEET OR MORE IN LENGTH [1]

[Coamings 24 inches in height]

HATCHWAY BEAMS

| Breadth of hatchway | Mounting | Beams with fore-and-afters, spacing center to center | | | Beams without fore-and-afters, spacing center to center | |
|---|---|---|---|---|---|---|
| | | 6′ 0″ | 8′ 0″ | 10′ 0″ | 4′ 0″ | 5′ 0″ |
| | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* |
| 10′ 0″ | 3 by 3 by 0.40A | 11 by 0.30P | 12 by 0.32P | 14 by 0.34P | 9 by 0.46BP | 10 by 0.50BP. |
| 12′ 0″ | 3 by 3 by 0.40A | 12 by 0.32P | 14 by 0.34P | 17 by 0.36P | 11 by 0.50BP | 12 by 0.50BP. |
| 14′ 0″ | 3 by 3 by 0.42A | 14 by 0.34P | 17 by 0.36P | 20 by 0.38P | 12 by 0.50BP | 12 by 0.32P. |
| 16′ 0″ | 3½ by 3 by 0.42A | 16 by 0.36P | 19 by 0.38P | 22 by 0.38P | 12 by 0.32P | 14 by 0.34P. |
| 18′ 0″ | 4 by 3 by 0.44A | 18 by 0.36P | 21 by 0.38P | 25 by 0.40P | 14 by 0.34P | 16 by 0.36P. |
| 20′ 0″ | 4 by 3 by 0.44A | 20 by 0.38P | 24 by 0.40P | 28 by 0.42P | 15 by 0.34P | 18 by 0.36P. |
| 22′ 0″ | 4½ by 3 by 0.46A | 22 by 0.38P | 26 by 0.42P | 30 by 0.44P | 16 by 0.36P | 19 by 0.36P. |
| 24′ 0″ | 5 by 3½ by 0.46A | 23 by 0.40P | 28 by 0.42P | 32 by 0.44P | 17 by 0.36P | 20 by 0.38P. |
| 26′ 0″ | 5½ by 3½ by 0.48A | 24 by 0.40P | 29 by 0.42P | 34 by 0.46P | 18 by 0.36P | 21 by 0.38P. |
| 28′ 0″ | 6 by 3½ by 0.50A | 25 by 0.40P | 31 by 0.44P | 36 by 0.48P | 19 by 0.38P | 22 by 0.38P. |
| 30′ 0″ | 6 by 3½ by 0.52A | 26 by 0.42P | 32 by 0.44P | 38 by 0.48P | 20 by 0.38P | 23 by 0.40P. |

FORE-AND-AFTERS

| Length of fore-and-afters | Mounting | Bulb plate center fore-and-afters, spacing center to center | | | Bulb angle side fore-and-afters, spacing center to center | | |
|---|---|---|---|---|---|---|---|
| | | 3′ 0″ | 4′ 0″ | 5′ 0″ | 3′ 0″ | 4′ 0″ | 5′ 0″ |
| | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* |
| 6′ 0″ | 2½ by 2½ by 0.36 | 6 by 0.36 | 6½ by 0.38 | 7 by 0.38 | 6 by 3 by 0.36 | 6½ by 3½ by 0.38 | 7 by 3½ by 0.38. |
| 8′ 0″ | 2½ by 2½ by 0.38 | 7 by 0.42 | 8 by 0.44 | 9 by 0.44 | 7 by 3½ by 0.42 | 8 by 3 by 0.44 | 9 by 3½ by 0.44. |
| 10′ 0″ | 2½ by 2½ by 0.40 | 8 by 0.50 | 9½ by 0.50 | 11 by 0.50 | 8 by 3½ by 0.50 | 9½ by 3½ by 0.50 | 11 by 3½ by 0.50. |

| Length of fore-and-afters | Wood center fore-and-afters, spacing center to center | | | | | | Wood side fore-and-afters, spacing center to center | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3′ 0″ | | 4′ 0″ | | 5′ 0″ | | 3′ 0″ | | 4′ 0″ | | 5′ 0″ | |
| | D | B | D | B | D | B | D | B | D | B | D | B |
| | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* |
| 6′0″ | 5½ | 7 | 6 | 7 | 6½ | 7 | 5½ | 5½ | 6 | 6 | 6½ | 6 |
| 8′0″ | 6½ | 7 | 7½ | 7 | 8 | 7 | 6½ | 6½ | 7½ | 7 | 8 | 7 |
| 10′0″ | 8 | 7 | 8½ | 8 | 9 | 9 | 8 | 7 | 8½ | 8 | 9 | 9 |

A=Plain angle. BP=Bulb plate. P=Plate. D=Depth. B=Breadth.

[1] In vessels not exceeding 100 feet in length, the depths of beams which are formed of plates and angles may be 60 percent of the depths given above; the depths of beams and steel fore-and-afters formed of bulb angle or bulb plate section may be 80 percent of the depths given above; the thickness of plates, bulb angles, and bulb plates should correspond to the thickness tabulated for the reduced depths with a minimum thickness of 0.30 inch; the depths and breadths of wood fore-and-afters may be 80 percent of those given in the tables for side fore-and-afters, but the center fore-and-afters must be not less than 6½ inches wide. In vessels between 100 feet and 200 feet in length, the sizes of the beams and fore-and-afters are to be determined by linear interpolation.

[2] Depths for hatchway beams are at the middle of the length and are measured from the top mounting to the lower edge. Depths for fore-and-afters are measured from the underside of the hatch covers to the lower edge. Sizes for intermediate lengths and spacing are obtained by interpolation. Where plates are specified, two angles of the size given for mountings, are to be fitted at the upper and at the lower part of the beam. Where bulb plates are specified, two angles, of the size given for mountings, are to be fitted at the upper part of the beam or fore-and-after. Where bulb angles are specified, one angle, of the size given for mountings, is to be fitted at the upper part of the section. Where the specified flanges of an angle are of different dimensions, the larger flange is to be horizontal.

TABLE 43.10-20 (a2)—HATCHWAY BEAMS AND FORE-AND-AFTERS FOR VESSELS 200 FEET OR MORE IN LENGTH [1]

[Coamings 18 inches in height]

HATCHWAY BEAMS

| Breadth of hatchway | Mounting | Beams with fore-and-afters, spacing center to center | | | Beams without fore-and-afters, spacing center to center | |
|---|---|---|---|---|---|---|
| | | 6' 0" | 8' 0" | 10' 0" | 4' 0" | 5' 0" |
| | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* |
| 10'0" | 3 by 3 by 0.40A | 9½ by 0.46BP | 10½ by 0.50BP | 11½ by 0.52BP | 8 by 0.40 BP | 9 by 0.44BP. |
| 12'0" | 3 by 3 by 0.40A | 11 by 0.50BP | 11 by 0.30P | 13 by 0.34P | 9 by 0.44BP | 10 by 0.50BP. |
| 14'0" | 3 by 3 by 0.42A | 11 by 0.30P | 13 by 0.32P | 15 by 0.34P | 10 by 0.50BP | 11½ by 0.50BP. |
| 16'0" | 3½ by 3 by 0.42A | 12 by 0.32P | 15 by 0.34P | 17 by 0.36P | 11 by 0.30P | 11 by 0.30P. |
| 18'0" | 4 by 3 by 0.44A | 14 by 0.34P | 17 by 0.36P | 19 by 0.38P | 11 by 0.30P | 12 by 0.32P. |
| 20'0" | 4 by 3 by 0.44A | 16 by 0.36P | 19 by 0.38P | 21 by 0.38P | 12 by 0.32P | 13 by 0.34P. |
| 22'0" | 4½ by 3 by 0.46A | 17 by 0.36P | 20 by 0.38P | 23 by 0.40P | 12½ by 0.32P | 14 by 0.34P. |
| 24'0" | 5 by 3½ by 0.46A | 18 by 0.36P | 21 by 0.38P | 25 by 0.40P | 13 by 0.34P | 14½ by 0.34P. |
| 26'0" | 5½ by 3½ by 0.48A | 19 by 0.38P | 22 by 0.38P | 26 by 0.42P | 13½ by 0.34P | 15 by 0.34P. |
| 28'0" | 6 by 3½ by 0.50A | 20 by 0.38P | 23 by 0.40P | 27 by 0.42P | 14 by 0.34P | 16 by 0.36P. |
| 30'0" | 6 by 3½ by 0.52A | 21 by 0.38P | 24 by 0.40P | 28 by 0.42P | 15 by 0.34P | 17 by 0.36P. |

FORE-AND-AFTERS

| Length of fore-and-afters | Mounting | Bulb plate center fore-and-afters, spacing center to center | | | Bulb angle side fore-and-afters, spacing center to center | | |
|---|---|---|---|---|---|---|---|
| | | 3' 0" | 4' 0" | 5' 0" | 3' 0" | 4' 0" | 5' 0" |
| | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* |
| 6'0" | 2½ by 2½ by 0.36 | 5 by 0.34 | 5½ by 0.34 | 6 by 0.36 | 5 by 3 by 0.36 | 5½ by 3 by 0.34 | 6 by 3 by 0.36. |
| 8'0" | 2½ by 2½ by 0.38 | 6 by 0.38 | 7 by 0.40 | 7½ by 0.42 | 6 by 3 by 0.38 | 7 by 3 by 0.40 | 7½ by 3½ by 0.42. |
| 10'0" | 2½ by 2½ by 0.40 | 7 by 0.44 | 8 by 0.46 | 9 by 0.50 | 7 by 3 by 0.44 | 8 by 3½ by 0.46 | 9 by 3½ by 0.50. |

| Length of fore-and-afters | Wood center fore-and-afters, spacing center to center | | | | | | Wood side fore-and-afters, spacing center to center | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3' 0" | | 4' 0" | | 5' 0" | | 3' 0" | | 4' 0" | | 5' 0" | |
| | D | B | D | B | D | B | D | B | D | B | D | B |
| | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* | *Inches* |
| 6'0" | 5 | 7 | 5½ | 7 | 6 | 7 | 5 | 5 | 5½ | 5 | 6 | 5 |
| 8'0" | 6 | 7 | 6½ | 7 | 7 | 7 | 6 | 5 | 6½ | 6 | 7 | 6 |
| 10'0" | 7 | 7 | 7½ | 7 | 8 | 7 | 7 | 6 | 7½ | 7 | 8 | 7 |

A=Plain angle. BP=Bulb plate. P=Plate. D=Depth. B=Breadth.

[1] In vessels not exceeding 100 feet in length, the depths of beams which are formed of plates and angles may be 60 percent of the depths given above; the depths of beams and steel fore-and-afters formed of bulb angle or bulb plate section may be 80 percent of the depths given above; the thickness of plates, bulb angles, and bulb plates should correspond to the thickness tabulated for the reduced depths with a minimum thickness of 0.30 inch; the depths and breadths of wood fore-and-afters may be 80 percent of those given in the tables for side fore-and-afters, but the center fore-and-afters must be not less than 6½ inches wide. In vessels between 100 feet and 200 feet in length, the sizes of the beams and fore-and-afters are to be determined by linear interpolation.

[2] Depths for hatchway beams are at the middle of the length and are measured from the top mounting to the lower edge. Depths for fore-and-afters are measured from the under side of the hatch covers to the lower edge. Sizes for intermediate length and spacing are obtained by interpolation. Where plates are specified, two angles, of the sizes given for mountings, are to be fitted at the upper and at the lower part of the beam. Where bulb plates are specified, two angles, of the size given for mountings, are to be fitted at the upper part of the beam or fore-and-after. Where bulb angles are specified, one angle, of the size given for mountings, is to be fitted at the upper part of the section. Where the specified flanges of an angle are of different dimensions, the larger flange is to be horizontal.

**§ 43.10–25 Carriers or sockets.**

(a) Carriers or sockets for hatchway beams and fore-and-afters are to be of steel at least one-half inch thick, and are to have a width of bearing surface of at least 3 inches.

**§ 43.10–30 Cleats.**

(a) Strong cleats at least 2½ inches wide are to be fitted at intervals of not more than 2 feet from center to center; the end cleats are to be placed not more than 6 inches from each corner of the hatchway.

**§ 43.10–35 Battens and wedges.**

(a) Battens and wedges are to be efficient and in good condition.

**§ 43.10–40 Tarpaulins.**

(a) At least two tarpaulins in good condition, thoroughly waterproofed, and of ample strength, are to be provided for each hatchway in an exposed position on freeboard and superstructure decks. The material is to be guaranteed free from jute, and shall not be less than No. 4 cotton canvas or No. 6 hemp canvas before waterproofing, or shall be of suitable synthetic fabric as approved for this purpose by the Load Line Assigning Authority.

**§ 43.10–45 Security of hatchway covers.**

(a) At all hatchways in exposed positions on freeboard and superstructure decks ring bolts or other fittings for lashings are to be provided.

(b) Where the breadth of the hatchway exceeds 60 percent of the breadth of the deck in way of the hatchway, and the coamings are required to be 24 inches high, fittings for special lashings are to be provided for securing the hatchway covers after the tarpaulins are battened down.

**§ 43.10–50 Cargo and other hatchways in the freeboard deck within superstructures which are fitted with closing appliances less efficient than class 1.**

(a) The construction and fittings of such hatchways are to be at least equivalent to the standards laid down in § 43.10–55.

**§ 43.10–55 Hatchway coamings and closing arrangements.**

(a) Cargo, coaling, and other hatchways in the freeboard deck within superstructures which are fitted with class 2 closing appliances are to have coamings at least 9 inches in height and closing arrangements as effective as those required for exposed cargo hatchways whose coamings are 18 inches high.

(b) Where the closing appliances are less efficient than class 2, the hatchways are to have coamings at least 18 inches in height, and are to have fittings and closing arrangements as effective as those required for exposed cargo hatchways.

CROSS REFERENCE: For class 1 and class 2 closing appliances, see §§ 43.15–37, 43.15–40.

**§ 43.10–60 Machinery space openings in exposed positions on freeboard and raised quarter-decks.**

(a) Such openings are to be properly framed and efficiently enclosed by steel casings of ample strength, and where the casings are not protected by other structures their strength is to be specially considered. Doors in such casings are to be of steel, efficiently stiffened, permanently attached, and capable of being closed and secured from both sides. The sills of openings are to be at least 24 inches above the freeboard deck and at least 18 inches above the raised quarter-deck.

(b) Fiddley, funnel, and ventilator coamings are to be as high above the deck as is reasonable and practicable. Fiddley openings are to have strong steel covers permanently attached in their proper positions.

**§ 43.10–65 Machinery space openings in exposed positions on superstructure decks other than raised quarter-decks.**

(a) Such openings are to be properly framed and efficiently enclosed by strong steel casings. Doors in such cases are to be strongly constructed, permanently attached, and capable of being closed and secured from both sides. The sills

of the openings are to be at least 15 inches above superstructure decks.

(b) Fiddley, funnel, and ventilator coamings are to be as high above the deck as is reasonable and practicable. Fiddley openings are to have strong steel covers permanently attached in their proper positions.

**§ 43.10–67 Machinery space openings in the freeboard deck within superstructures which are fitted with closing appliances less efficient than class 1.**

(a) Such openings are to be properly framed and efficiently enclosed by steel casings. Doors in such casings are to be strongly constructed, permanently attached, and capable of being securely closed. The sills of the openings are to be at least 9 inches above the deck where the superstructures are closed by class 2 closing appliances, and at least 15 inches above the deck where the closing appliances are less efficient than class 2.

CROSS REFERENCE: For class 1 and class 2 closing appliances, see §§ 43.15–37, 43.15–40.

**§ 43.10–70 Flush bunker scuttles.**

(a) Flush bunker scuttles may be fitted in superstructure decks, and where so fitted are to be of iron or steel, of substantial construction, with screw or bayonet joints. Where a scuttle is not secured by hinges, a permanent chain attachment is to be provided. The position of flush bunker scuttles in small vessels in special trades is to be dealt with by each assigning authority.

**§ 43.10–75 Companionways.**

(a) Companionways in exposed positions on freeboard decks and on decks of enclosed superstructures are to be of substantial construction. The sills of the doorways are to be of the heights specified for hatchway coamings (see §§ 43.10–10, 43.10–55). The doors are to be strongly constructed and capable of being closed and secured from both sides. Where the companionway is situated within a quarter of the vessel's length from the stem, it is to be of steel and riveted to the deck plating.

**§ 43.10–77 Ventilators in exposed positions on freeboard and superstructure decks.**

(a) Such ventilators to spaces below freeboard decks or decks of superstructures which are intact or fitted with class 1 closing appliances are to have coamings of steel, substantially constructed, and efficiently connected to the deck by rivets spaced four diameters apart center to center, or by equally effective means. The deck plating at the base of the coamings is to be efficiently stiffened between the deck beams. The ventilator openings are to be provided with efficient closing arrangements.

(b) Where such ventilators are situated on the freeboard deck, or on the superstructure deck within a quarter of the vessel's length from the stem, and the closing arrangements are of a temporary character, the coamings are to be at least 36 inches in height; in other exposed positions on the superstructure deck they are to be at least 30 inches in height. Where the coaming of any ventilator exceeds 36 inches in height, it is to be specially supported and secured.

**§ 43.10–80 Air pipes.**

(a) Where the air pipes to ballast and other tanks extend above the freeboard or superstructure decks, the exposed parts of the pipes are to be of substantial construction; the height from the deck to the opening is to be at least 36 inches in wells on freeboard decks, 30 inches on raised quarter decks, and 18 inches on other superstructure decks. Satisfactory means are to be provided for closing the openings of the air pipes.

**§ 43.10–85 Gangway, cargo, and coaling ports.**

(a) Openings in the sides of vessels below the freeboard deck are to be fitted with watertight doors or covers, which, with their securing appliances, are to be of sufficient strength.

**§ 43.10–87 Scuppers and sanitary discharge pipes.**

(a) Discharges from scuppers and sanitary pipes led through the vessel's sides from spaces below the freeboard deck are to be fitted with efficient and accessible means for preventing water from passing inboard. Each separate discharge may have an automatic nonreturn valve with a positive means of closing it from a readily accessible position above the freeboard deck, or two automatic nonreturn valves without positive means of closing, provided the upper valve is situated so that it is always accessible for examination under service conditions. The positive-action valve is to be accessible and is to be provided with means for showing whether the valve is opened or closed.

(b) Conditional upon the type and the location of the inboard ends of such openings, similar provisions may be prescribed by the assigning authority as to discharge from spaces within enclosed superstructures.

(c) Where scuppers are fitted in superstructures not fitted with class 1 closing appliances they are to have efficient means for preventing the accidental admission of water below the freeboard deck.

**§ 43.10–90 Air ports.**

(a) Air ports to spaces below the freeboard deck or to spaces below the superstructure deck of superstructures closed by class 1 or class 2 closing appliances are to be fitted with efficient inside deadlights permanently attached in their proper positions so that they can be effectively closed and secured watertight.

(b) Where, however, such spaces in superstructures are appropriated to passengers other than steerage passengers or to crew, the air ports may have portable deadlights stowed adjacent to the air ports, provided they are readily accessible at all times on service.

(c) The air ports and deadlights are to be of substantial and approved construction.

CROSS REFERENCE: For class 1 and class 2 closing appliances, see §§ 43.15–37, 43.15–40.

**§ 43.10–95 Guardrails.**

(a) Efficient guardrails or bulwarks are to be fitted on all exposed portions of freeboard and superstructure decks.

**§ 43.10–97 Freeing ports.**

(a) Where bulwarks on the weather portions of freeboard or superstructure decks form "wells" ample provision is to be made for rapidly freeing the decks of water and for draining them. The minimum freeing port area on each side of the vessel for each well on the freeboard deck and on the raised quarterdeck is to be that given by the following scale: The minimum area for each well on any other superstructure deck is to be one-half the area given by the scale. Where the length of the well exceeds 0.7 *L*, the scale may be modified.

SCALE OF FREEING PORT AREA

| Length of bulwarks in "well" in feet: | *Freeing port area on each side in square feet* |
|---|---|
| 15 | 8.0 |
| 20 | 8.5 |
| 25 | 9.0 |
| 30 | 9.5 |
| 35 | 10.0 |
| 40 | 10.5 |
| 45 | 11.0 |
| 50 | 11.5 |
| 55 | 12.0 |
| 60 | 12.5 |
| 65 | 13.0 |
| Above 65 | [1] |

[1] One square foot for each additional 5 feet length of bulwark.

(b) The lower edges of the freeing ports are to be as near the deck as practicable and preferably not higher than the upper edge of the gunwale bar. Two-thirds of the freeing port area required is to be provided in the midship half of the well. In vessels with less than the standard sheer the freeing port area is to be suitably increased.

(c) All such openings in the bulwarks are to be protected by rails or bars spaced about 9 inches apart. If shutters are fitted to freeing ports, ample clearance is to be provided to prevent jamming. Hinges are to have brass pins.

**§ 43.10–100 Protection of crew.**

(a) Gangways, lifelines, or other satisfactory means are to be provided for the protection of the crew in getting to and from their quarters. The strength of houses for the accommodation of crew on flush deck steamers is to be equivalent to that required for superstructure bulkheads.

## Subpart 43.15—Load Lines for Steamers [3]

### § 43.15–1 Length (L).

(a) The length used with the rules and freeboard tables is the length in feet on the summer load water line from the foreside of the stem to the afterside of the rudder post. Where there is no rudder post, the length is measured from the foreside of the stem to the axis of the rudder stock. For vessels with cruiser sterns, the length is to be taken as 96 percent of the total length on the designed summer load waterline or as the length from the foreside of the stem to the axis of the rudder stock if that be the greater.

### § 43.15–5 Breadth (B).

(a) The breadth is the maximum breadth in feet amidships to the molded line of the frame in iron or steel vessels and to the outside of the planking in wood or composite vessels.

### § 43.15–7 Molded depth.

(a) The molded depth is the vertical distance in feet, measured amidships, from the top of the keel to the top of the freeboard deck beam at side. In wood and composite vessels the distance is measured from the lower edge of the keel rabbet. Where the form at the lower part of the midship section is of a hollow character, or where thick garboards are fitted, the depth is measured from the point where the line of the flat of the bottom continued inwards cuts the side of the keel.

### § 43.15–10 Depth for freeboard (D).

(a) The depth used with the freeboard table is the molded depth plus the thickness of stringer plate, or plus

$$\frac{T\ (L-S)}{L} \qquad (1)$$

if that be greater, where

$T$ is the mean thickness of the exposed deck clear of deck openings, and

$S$ is the total length of superstructures as defined in § 43.15–27.

(b) Where the topsides are of unusual form, $D$ is the depth of a midship section having vertical topsides, standard round of beam, and area of topside section equal to that in the actual midship section. Where there is a step or break in the topsides (that is, as in the turret-deck vessel) 70 percent of the area above the step or break is included in the area used to determine the equivalent section.

(c) In a vessel without an enclosed superstructure covering at least 0.6L amidships, without a complete trunk or without a combination of intact partial superstructures and trunk extending all fore-and-aft, where $D$ is less than $\frac{L}{15}$, the depth used with the table is not to be taken as less than $\frac{L}{15}$.

### § 43.15–15 Coefficient of fineness (c).

(a) The coefficient of fineness used with the freeboard table is given by

$$c=\frac{35\Delta}{L.B.d_1} \qquad (1)$$

where $\Delta$ is the vessel's molded displacement in tons (excluding bossing) at a mean molded draft $d_1$ which is 85 percent of the molded depth.

(b) The coefficient $c$ is not to be taken as less than 0.68.

### § 43.15–17 Strength.

(a) The assigning authority is to be satisfied with the structural strength of vessels to which freeboards are assigned.

(b) Vessels which comply with the highest standard of the rules of a classification society recognized by the Commandant, U. S. Coast Guard, shall be regarded as having sufficient strength for the minimum freeboards allowed under the regulations in this part.

(c) Vessels which do not comply with the highest standard of the rules of a classification society recognized by the Commandant, U. S. Coast Guard, shall be assigned such increased freeboards as shall be determined by the assigning authority, and for guidance the following strength moduli are formulated:

(1) *Material.* The strength moduli are based on the assumption that the structure is built of mild steel, manufactured by the open-hearth process (acid or basic), and having a tensile strength of 26 to 32 tons per square inch, and an elongation of at least 16 percent, on a length of 8 inches.

(2) *Strength deck.* The strength deck is the uppermost deck which is incorporated into and forms an integral part of the longitudinal girder within the half-length amidships.

(3) *Depth to strength deck (Ds).* The depth to strength deck is the vertical distance in feet amidships from the top of the keel to the top of the strength deck beam at side.

(4) *Draft (d).* The draft is the vertical distance in feet amidships from the top of the keel to the center of the disk.

(5) *Longitudinal modulus.* The longitudinal modulus $\frac{I}{y}$ is the moment of inertia $I$ of the midship section about the neutral axis divided by the distance $y$ measured from the neutral axis to the top of the strength deck beam at side, calculated in way of openings but without deductions for rivet holes. Areas are measured in square inches and distances in feet.

(i) Below the strength deck, all continuous longitudinal members other than such parts of underdeck girders as are required entirely for supporting purposes are included. Above the strength deck, the gunwale angle bar and the extension of the sheerstrake are the only members included.

(ii) The required longitudinal modulus for effective material is expressed by $f.\ d.\ B.$, where $f$ is the factor obtained from Table 43.15–17(c)(5)(ii).

TABLE 43.15–17 (c) (5) (ii)

| $L$ | $f$ | $L$ | $f$ | $L$ | $f$ |
|---|---|---|---|---|---|
| 100 | 1.80 | 280 | 6.20 | 460 | 14.15 |
| 120 | 2.00 | 300 | 6.95 | 480 | 15.15 |
| 140 | 2.35 | 320 | 7.70 | 500 | 16.25 |
| 160 | 2.70 | 340 | 8.55 | 520 | 17.35 |
| 180 | 3.15 | 360 | 9.40 | 540 | 18.45 |
| 200 | 3.60 | 380 | 10.30 | 560 | 19.60 |
| 220 | 4.20 | 400 | 11.20 | 580 | 20.80 |
| 240 | 4.80 | 420 | 12.15 | 600 | 22.00 |
| 260 | 5.45 | 440 | 13.10 | | |

(iii) For intermediate lengths, the value of $f$ is determined by interpolation. This formula applies where $L$ does not exceed 600 feet; $B$ is between

$$\frac{L}{10}+5 \text{ and } \frac{L}{10}+20 \qquad (1)$$

both inclusive, and $\frac{L}{D_s}$ is between 10 and 13.5, both inclusive.

(6) *Frame.* For the purpose of the frame modulus, the frame is regarded as composed of a frame angle and a reverse angle each of the same size and thickness.

(7) *Frame modulus.* The modulus $\frac{I}{y}$ of the midship frame below the lowest tier of beams is the moment of inertia $I$ of the frame section about the neutral axis divided by the distance $y$ measured from the neutral axis to the extremity of the frame section, calculated without deduction for rivet and bolt holes. The modulus is measured in inch units.

(i) The required frame modulus is expressed by

$$\frac{s(d-t)\ (f_1+f_2)}{1{,}000} \qquad (2)$$

where:

$s$ is the frame spacing in inches.

$t$ is the vertical distance in feet measured at amidships from the top of the keel to a point midway between the top of the inner bottom at side and the top of the heel bracket (see fig. 43.15–17 (c) (7) (i)); where there is no double bottom, $t$ is measured to a point midway between the top of the floor at center and the top of the floor at side.

$f_1$ is a coefficient depending on $H$, which, in vessels fitted with double bottoms, is the vertical distance in feet from the middle of the beam bracket of the lowest tier of beams at side to a point midway between the top of the inner bottom at side and the top of the heel bracket (see fig. 43.15–17 (c) (7) (i)); where there is no double bottom, $H$ is measured to a point midway between the top of the floor at center and the top of the floor at side. Where the frame obtains additional strength from the form of the vessel, due allowance is made in the value of $f_1$.

$f_2$ is a coefficient depending on $K$, which is the vertical distance in feet from the top of the lowest tier of beams at side to a point 7 feet 6 inches above the freeboard deck at side, or, if there is

[3] The provisions of §§ 43.01–1—43.01–100, inclusive, and §§ 43.05–1—43.10–100, inclusive, apply to all vessels and for steamers, are further supplemented by §§ 43.15–1—43.15–98, inclusive. Steamers taking advantage of special classifications, such as tankers, steamers carrying timber deck cargo, lumber schooners, etc., are also subject to these requirements except as specifically modified in their separate classifications as set forth in the regulations.

TABLE 43.15-17 (c) (7) (i)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $H$ in feet | 0 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 23 | 25 |
| $f_1$ | 9 | 11 | 12.5 | 15 | 19 | 24 | 29.5 | 36 | 43 | 51 | 59 |
| $K$ in feet | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | ..... | ..... |
| $f_2$ | 0 | 0.5 | 1.0 | 2.0 | 3.0 | 4.5 | 6.5 | 9.0 | 12.0 | ..... | ..... |

Intermediate values are obtained by interpolation.

a superstructure, to a point 12 feet 6 inches above the freeboard deck at side. (See fig. 43.15-17 (c) (7) (i).) The values of $f_1$ *and* $f_2$ are obtained from Table 43.15-17 (c) (7) (i).

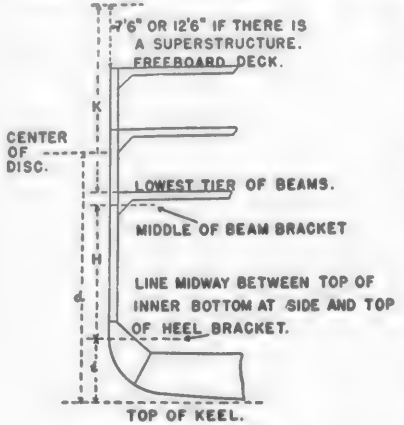

7'6" OR 12'6" IF THERE IS A SUPERSTRUCTURE.
FREEBOARD DECK.
K
CENTER OF DISC.
LOWEST TIER OF BEAMS.
MIDDLE OF BEAM BRACKET
H
LINE MIDWAY BETWEEN TOP OF INNER BOTTOM AT SIDE AND TOP OF HEEL BRACKET.
d
TOP OF KEEL.

FIGURE 43.15-17 (c) (7) (i)

(ii) This formula applies where $D$ is between 15 feet and 60 feet, both inclusive, $B$ is between

$$\frac{L}{10}+5 \text{ and } \frac{L}{10}+20, \text{ both inclusive, } \frac{L}{D_s}$$

is between 10 and 13.5, both inclusive, and the horizontal distance from the outside of the frame to the center of the first row of pillars does not exceed 20 feet.

(iii) In single-deck vessels of ordinary form, where $H$ does not exceed 18 feet, the frame modulus determined by the preceding method is multiplied by the factor $f_3$ where

$$f_3=0.50+0.05\ (H-8) \qquad (3)$$

(iv) Where the horizontal distance from the outside of the frame to the center of the first row of pillars exceeds 20 feet, the assigning authority is to be satisfied that sufficient additional strength is provided.

**§ 43.15–20 Height of superstructure.**

(a) The height of a superstructure is the least vertical height measured from the top of the superstructure deck to the top of the freeboard deck beams minus the difference between $D$ and the molded depth. (See §§ 43.15–7, 43.15–10.)

**§ 43.15–25 Standard height of superstructure.**

(a) The standard height of a raised quarter-deck is 3 feet for vessels up to and including 100 feet in length, 4 feet for vessels 250 feet in length, and 6 feet for vessels 400 feet in length and above. The standard height of any other superstructure is 6 feet for vessels up to and including 250 feet in length and 7 feet 6 inches for vessels 400 feet in length and above. The standard height at intermediate lengths is obtained by interpolation.

**§ 43.15–27 Length of superstructure (S).**

(a) The length of a superstructure is the mean covered length of the parts of the superstructure which extends to the sides of the vessel and lie within lines drawn perpendicular to the extremities of the summer load waterline, as defined in § 43.15–1.

**§ 43.15–30 Enclosed superstructure.**

(a) A detached superstructure is regarded as inclosed only where:

(1) The enclosing bulkheads are of efficient construction. (See § 43.15–35.)

(2) The access openings in these bulkheads are fitted with class 1 or class 2 closing appliances. (See §§ 43.15–37, 43.15–40.)

(3) All other openings in sides or ends of the superstructure are fitted with efficient weathertight means of closing.

(4) Independent means of access to crew, machinery, bunker, and other working spaces within bridges and poops are at all times available when the bulkhead openings are closed.

**§ 43.15–35 Superstructure bulkheads.**

(a) Bulkheads at exposed ends of poops, bridges, and forecastles are deemed to be of efficient construction where the assigning authority is satisfied that, in the circumstances, they are equivalent to the following standard for vessels with minimum freeboards under which standard the stiffeners and plating are of the scantlings given in Table 43.15–35(a), the stiffeners are spaced 30 inches apart, the stiffeners on poop and bridge front bulkheads have efficient end connections, and those on after bulkheads of bridges and forecastles extend for the whole distance between the margin angles of the bulkheads.

TABLE 43.15-35 (a)—EXPOSED BULKHEADS OF SUPERSTRUCTURES OF STANDARD HEIGHT

| Bridge front bulkheads, unprotected bulkheads of poops $0.4L$ or more in length | | Bulkheads of poops partially protected or less in length than $0.4L$ | | After bulkheads of bridges and forecastles | |
|---|---|---|---|---|---|
| Length of vessel | Bulb angle stiffeners | Length of vessel | Plain angle stiffeners | Length of vessel | Plain angle stiffeners |
| *Feet* | *Inches* | *Feet* | *Inches* | *Feet* | *Inches* |
| Under 160 | 5½ by 3 by 0.30. | Under 150 | 3 by 2½ by 0.30. | Under 150 | 2½ by 2½ by 0.26. |
| 160 | 6 by 3 by 0.32. | 150 | 3½ by 2½ by 0.32. | 150 | 3 by 2½ by 0.28. |
| 200 | 6½ by 3 by 0.34. | 200 | 4 by 3 by 0.34. | 250 | 3½ by 3 by 0.30. |
| 240 | 7 by 3 by 0.36. | 250 | 4½ by 3 by 0.36. | 350 | 4 by 3 by 0.32. |
| 280 | 7½ by 3 by 0.38. | 300 | 5 by 3 by 0.38. | | |
| 320 | 8 by 3 by 0.40. | 350 | 5½ by 3 by 0.42. | | |
| 360 | 8½ by 3 by 0.42. | 400 | 6 by 3 by 0.44. | | |
| 400 | 9 by 3 by 0.44. | 450 | 6½ by 3½ by 0.46. | | |
| 440 | 9½ by 3½ by 0.46. | 500 | 7 by 3½ by 0.48. | | |
| 480 | 10 by 3½ by 0.48. | 550 | 7 by 3½ by 0.50. | | |
| 520 | 10½ by 3½ by 0.50. | | | | |
| 560 | 11 by 3½ by 0.52. | | | | |

| Length of vessel | Bulkhead plating [1] | Length of vessel | Bulkhead plating [1] | Length of vessel | Bulkhead plating [1] |
|---|---|---|---|---|---|
| *Feet* | *Inch* | *Feet* | *Inch* | *Feet* | *Inch* |
| 200 and under | 0.3 | 160 and under | 0.24 | 160 and under | 0.20 |
| 380 and above | .44 | 400 and above | .38 | 400 and above | .30 |

[1] For vessels intermediate in length the thicknesses of bulkhead plating are obtained by interpolation.

**§ 43.15–37 Class 1 closing appliances.**

(a) These appliances are of iron or steel, are in all cases to be permanently and strongly attached to the bulkhead, are framed, stiffened, and fitted so that the whole structure is of equivalent strength to the unpierced bulkhead, and are weathertight when closed. The means for securing these appliances are permanently attached to the bulkhead or to the appliances, and the latter are so arranged that they can be closed and secured from both sides of the bulkhead or from the deck above. The sills of the access openings are at least 15 inches above the deck.

**§ 43.15–40 Class 2 closing appliances.**

(a) These appliances are:

(1) Strongly framed hardwood hinged doors, which are not more than 30 inches wide nor less than 2 inches thick; or

(2) Shifting boards fitted for the full height of the opening in channels riveted to the bulkhead, the shifting boards being at least 2 inches thick where the width of opening is 30 inches or less, and increased in thickness at the rate of 1 inch for each additional 15 inches of width; or

(3) Portable plates of equal efficiency.

**§ 43.15–43 Temporary closing appliances.**

(a) Temporary closing appliances for middle line openings in the deck of an enclosed superstructure consist of

(1) A steel coaming not less than 9 inches in height efficiently riveted to the deck;

(2) Hatchway covers as required by § 43.10–15, secured by hemp lashings; and

(3) Hatchway supports as required by §§ 43.10–20, 43.10–25 and by Table 43.10–20 (a1) or 43.10–20 (a2).

**§ 43.15–45 General, relative superstructures.**

(a) Where exposed bulkheads of the ends of poops, bridges, and forecastles are not of efficient construction (see § 43.10–25), they are considered as nonexistent.

(b) Where in the side plating of a superstructure there is an opening not provided with permanent means of closing, the part of the superstructure in way of the opening is regarded as having no effective length.

(c) Where the height of a superstructure is less than the standard, its length is reduced in the ratio of the actual to the standard height. Where the height exceeds the standard, no increase is made in the length of the superstructure.

**§ 43.15–47 Poop.**

(a) Where there is an efficient bulkhead and the access openings are fitted with class 1 closing appliances (§ 43.15–37), the length to the bulkhead is effective. Where the access openings in an efficient bulkhead are fitted with class 2 closing appliances (§ 43.15–40) and the length to the bulkhead is $0.5L$ or less, 100 percent of that length is effective; where the length is $0.7L$ or more, 90 percent of that length is effective; where the length is between $0.5L$ and $0.7L$, an intermediate percentage of that length is effective; where an allowance is given for an efficient adjacent trunk (see § 43.15–57), 90 percent of the length to the bulkhead is to be taken as effective; 50 percent of the length of an open poop or of an open extension beyond an efficient bulkhead is effective.

**§ 43.15–50 Raised quarter-deck.**

(a) Where there is an efficient intact bulkhead, the length to the bulkhead is effective. Where the bulkhead is not intact, the superstructure is considered as a poop of less than standard height.

**§ 43.15–53 Bridge.**

(a) Where there is an efficient bulkhead at each end, and the access openings in the bulkheads are fitted with class 1 closing appliances, the length between the bulkheads is effective.

(b) Where the access openings in the forward bulkhead are fitted with class 1 closing appliances and the access openings in the after bulkhead with class 2 closing appliances, the length between the bulkheads is effective; where an allowance is given for an efficient trunk, adjacent to the after bulkhead (see § 43.15–57), 90 percent of the length is effective. Where the access openings in both bulkheads are fitted with class 2 closing appliances, 90 percent of the length between the bulkheads is effective. Where the access openings in the forward bulkhead are fitted with class 1 or class 2 closing appliances and the access openings in the after bulkhead have no closing appliances, 75 percent of the length between the bulkheads is effective. Where the access openings in both bulkheads have no closing appliances, 50 percent of the length is effective; 75 percent of the length of an open extension beyond the after bulkhead and 50 percent of that beyond the forward bulkhead are effective.

CROSS REFERENCE: For class 1 and class 2 closing appliances, see §§ 43.15–37, 43.15–40.

**§ 43.15–55 Forecastle.**

(a) Where there is an efficient bulkhead and the access openings are fitted with class 1 or class 2 closing appliances, the length to the bulkhead is effective. Where no closing appliances are fitted and the sheer forward of amidships is not less than the standard sheer, 100 percent of the length of the forecastle forward of $0.1L$ from the forward perpendicular is effective; where the sheer forward is half the standard sheer or less, 50 percent of that length is effective; and where the sheer forward is intermediate between the standard and half the standard sheer, an intermediate percentage of that length is effective; 50 percent of the length of an open extension beyond the bulkhead or beyond $0.1L$ from the forward perpendicular is effective.

CROSS REFERENCE: For class 1 and class 2 closing appliances, see §§ 43.15–37, 43.15–40.

**§ 43.15–57 Trunk.**

(a) A trunk or similar structure which does not extend to the sides of the vessel is regarded as efficient: *Provided*, That:

(1) The trunk is at least as strong as a superstructure.

(2) The hatchways are in the trunk deck, and comply with the requirements of §§ 43.10–1—43.10–45 and the width of the trunk deck stringer provides a satisfactory gangway and sufficient lateral stiffness.

(3) A permanent working platform fore and aft fitted with guardrails is provided by the trunk deck, or by detached trunks connected to other superstructures by efficient permanent gangways.

(4) Ventilators are protected by the trunk, by watertight covers or by equivalent means.

(5) Open rails are fitted on the weather portions of the freeboard deck in way of the trunk for at least half their length.

(6) The machinery casings are protected by the trunk, by a superstructure of standard height or by a deckhouse of the same height and of equivalent strength.

(b) Where access openings in poop and bridge bulkheads are fitted with class 1 closing appliances, 100 percent of the length of an efficient trunk reduced in the ratio of its mean breadth to $B$ is added to the effective length of the superstructures. Where the access openings in these bulkheads are not fitted with class 1 closing appliances 90 percent is added.

(c) The standard height of a trunk is the standard height of a bridge.

(d) Where the height of the trunk is less than the standard height of a bridge, the addition is reduced in the ratio of the actual to the standard height; where the height of hatchway coamings on the trunk deck is less than the standard height of coamings (see § 43.10–10), a reduction from the actual height of trunk is to be made which corresponds to the difference between the actual and the standard height of coamings.

**§ 43.15–60 Enclosed superstructure with middle line openings in the deck not provided with permanent means of closing.**

(a) Where there is an enclosed superstructure with one or more middle line openings in the deck not provided with permanent means of closing (see §§ 43.10–1—43.10–45), the effective length of the superstructure is determined as follows:

(1) Where efficient temporary closing appliances are not provided for the middle line deck openings (see § 43.15–43), or the breadth of openings is 80 percent or more of the breadth $B_1$ of the superstructure deck at the middle of the opening, the vessel is considered as having an open well in way of each opening, and freeing ports are to be provided in way of this well. The effective length of superstructure between openings is governed by §§ 43.15–47, 43.15–53, 43.15–55.

(2) Where efficient temporary closing appliances are provided for middle line deck openings, and the breadth of openings is less than $0.8B_1$ the effective length is governed by §§ 43.15–47, 43.15–53, 43.15–55, except that where access openings in between deck bulkheads are closed by class 2 closing appliances, they are regarded as being closed by class 1 closing appliances in determining the effective length. The total effective length is obtained by adding to the length determined by subparagraph (1) of this paragraph the difference between this length and the length of the vessel modified in the ratio of

$$\frac{B_1-b}{B_1}$$ where $b$=breadth of deck opening

where

$$\frac{B_1-b}{B_1}$$ is greater than 0.5, it is taken as 0.5

**§ 43.15–63 Deductions for superstructures.**

(a) Where the effective length of superstructures is $1.0L$, the deduction from the freeboard is 14 inches at 80 feet length of vessels, 34 inches at 280 feet length, and 42 inches at 400 feet length and above; deductions at intermediate lengths are obtained by interpolation. Where the total effective length of superstructures is less than $1.0L$ the deduction is a percentage obtained from Table 43.15–63(a):

TABLE 43.15-63 (a)—TOTAL EFFECTIVE LENGTH OF SUPERSTRUCTURES (E)

| Superstructures | 0 | 0.1L | 0.2L | 0.3L | 0.4L | 0.5L | 0.6L | 0.7L | 0.8L | 0.9L | 1.0L | Line |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Percent | Percent | Percent | Percent | Percent | Percent | Percent | Percent | Percent | Percent | Percent | |
| All types with forecastle and without detached bridge | 0 | 5 | 10 | 15 | 23.5 | 32 | 46 | 63 | 75.3 | 87.7 | 100 | A |
| All types with forecastle and detached bridge [1] | 0 | 6.3 | 12.7 | 19 | 27.5 | 40 | 46 | 63 | 75.3 | 87.7 | 100 | B |

[1] Where the effective length of a detached bridge is less than 0.2L the percentages are obtained by interpolation between lines B and A. Where no forecastle is fitted the above percentages are reduced by 5. Percentages for intermediate lengths of superstructures are obtained by interpolation.

### § 43.15–65 Sheer, general.

(a) The sheer is measured from the deck at side to a line of reference drawn parallel to the keel through the sheer line at amidships.

(b) In vessels designed to trim by the stern in service, the sheer may be measured in relation to the load line, provided an additional mark is placed at 0.25 *L* forward of amidships to indicate the assigned load line. This mark is to be similar to the load line disk amidships.

(c) In flush deck vessels and in vessels with detached superstructures the sheer is measured at the freeboard deck.

(d) In vessels with topsides of unusual form in which there is a step or break in the topsides, the sheer is considered in relation to the equivalent depth amidships. (See § 43.15–15.)

(e) In vessels with a superstructure of standard height which extends over the whole length of the freeboard deck, the sheer is measured at the superstructure deck; where the height exceeds the standard, the sheer may be considered in relation to the standard height.

(f) Where a superstructure is intact or access openings in its inclosing bulkheads are fitted with class 1 closing appliances (§ 43.15–37), and the superstructure deck has at least the same sheer as the exposed freeboard deck, the sheer of the enclosed portion of the freeboard deck is not taken into account.

### § 43.15–67 Standard sheer profile.

(a) The ordinates (in inches) of the standard sheer profile are given in Table 43.15–67 (a), where *L* is the number of feet in the length of the vessel.

TABLE 43.15-67 (a)

| Station | Ordinate | Factor |
|---|---|---|
| A. P.[1] | 0.1 *L*+10 | 1 |
| 1/6 L from A. P. | .0445*L*+ 4.45 | 4 |
| 1/3 L from A. P. | .011 *L*+ 1.1 | 2 |
| Amidships | 0 | 4 |
| 1/3 L from F. P.[2] | .022 *L*+ 2.2 | 2 |
| 1/6 L from F. P. | .089 *L*+ 8.9 | 4 |
| F. P. | .2 *L*+20 | 1 |

[1] A. P.=After end of summer load waterline.
[2] F. P.=Fore end of summer load waterline.

### § 43.15–70 Measurement of variations from standard sheer profile.

(a) Where the sheer profile differs from the standard, the 7 ordinates of each profile are multiplied by the appropriate factors given in the table of ordinates. The difference between the sums of the respective products, divided by 18, measures the deficiency or excess of sheer. Where the after half of the sheer profile is greater than the standard and the forward half is less than the standard, no credit is allowed for the part in excess and the deficiency only is measured.

(b) Where the forward half of the sheer profile exceeds the standard, and the after portion of the sheer profile is not less than 75 percent of the standard, credit is allowed for the part in excess; where the after part is less than 50 percent of the standard no credit is given for the excess sheer forward. Where the after sheer is between 50 percent and 75 percent of the standard, intermediate allowances may be granted for excess sheer forward.

### § 43.15–73 Correction for variations from standard sheer profile.

(a) The correction for sheer is the deficiency or excess of sheer (see § 43.15–70(a)) multiplied by $0.75-\frac{S}{2L}$ where S is the total length of superstructure, as defined in § 43.15–27.

### § 43.15–75 Addition for deficiency in sheer.

Where the sheer is less than the standard, the correction for deficiency in sheer (see § 43.15–73) is added to the freeboard.

### § 43.15–77 Deduction for excess sheer.

(a) In flush deck vessels and in vessels where an enclosed superstructure covers 0.1 *L* before and 0.1 *L* abaft amidships, the correction for excess of sheer (see § 43.15–73) is deducted from the freeboard; in vessels with detached superstructures where no enclosed superstructure covers amidships, no deduction is made from the freeboard; where an enclosed superstructure covers less than 0.1 *L* before and 0.1 *L* abaft amidships, the deduction is obtained by interpolation. The maximum deduction for excess sheer is 1½ inches at 100 feet and increases at the rate of 1½ inches for each additional 100 feet in the length of the vessel.

### § 43.15–80 Standard round of beam.

(a) The standard round of beam of the freeboard deck is one-fiftieth of the breadth of the vessel.

### § 43.15–83 Round of beam correction.

(a) Where the round of beam of the freeboard deck is greater or less than the standard, the freeboard is decreased or increased respectively by one-fourth of the difference between the actual and the standard round of beam, multiplied by the proportion of the length of the freeboard deck not covered by enclosed superstructures. Twice the standard round of beam is the maximum for which allowance is given.

### § 43.15–85 Summer freeboard.

(a) The minimum freeboard in summer is the freeboard derived from the freeboard table after corrections for departures from the standards and after deduction for superstructures. The freeboard in salt water measured from the intersection of the upper surface of the freeboard deck with the outer surface of the shell is not to be less than 2 inches.

### § 43.15–87 Tropical freeboard.

(a) Except as provided in paragraph (b) of this section, the minimum freeboard in the tropical zone is the freeboard obtained by a deduction from the summer freeboard of one-fourth inch per foot of summer draft measured from the top of the keel to the center of the disk. The freeboard in salt water measured from the intersection of the upper surface of the freeboard deck with the outer surface of the shell is not to be less than 2 inches.

(b) For vessels 400 feet and above in length engaged in coastwise voyages, the area on the west coast of the United States eastward of a rhumb line from the point 30° N. latitude, 120° W. longitude to the point 33° N. latitude, 123° W. longitude, and a line thence along the meridian 123° W. longitude to its intersection with land at 38° N. latitude shall be considered an extension of the seasonal tropical zone as defined in § 43.40–1(f)(5)(ii), and the minimum freeboard is determined as in paragraph (a) of this section. For vessels above 300 feet and up to 400 feet in length engaged in coastwise voyages the minimum freeboard in this area during the tropical seasons is the freeboard obtained by deduction from the summer freeboard of $\left(\frac{L}{400}-0.75\right)$ inch per foot of summer draft, and it shall be noted on the coastwise load line certificate when this provision has been applied. The freeboard in salt water measured from the intersection of the upper surface of the freeboard deck with the outer surface of the shell is not to be less than 2 inches.

### § 43.15–90 Winter freeboard.

(a) Except as provided in paragraph (b) of this section, the minimum freeboard in winter is the freeboard obtained by an addition to the summer freeboard of one-fourth inch per foot of summer draft, measured from the top of the keel to the center of the disk.

(b) For vessels 400 feet and above in length engaged in coastwise voyages, the area on the east coast of the United States west of a line drawn south along the meridian at 68°30′ W. longitude from where it intersects the coast to 40° N. latitude, thence along a rhumb line to the point 36° N. latitude, 73° W. longitude shall be considered an extension of the summer zone and the minimum freeboard shall be the summer freeboard. For vessels above 300 feet and up to 400 feet in length engaged in coastwise voyages the minimum freeboard, when in this area, in winter, is the freeboard obtained by an addition to the summer freeboard of $\left(1.00-\frac{L}{400}\right)$ inch per foot of summer draft, and it shall be noted

on the coastwise load line certificate when this provision has been applied.

**§ 43.15–93 Winter North Atlantic freeboard.**

(a) The minimum freeboard for vessels not exceeding 330 feet in length on voyages across the North Atlantic from a port or place of departure north of latitude 36° N. to a port or place of arrival north of latitude 36° N., regardless of the route of the vessel while it is in either of the northern seasonal winter zones during the winter season, shall be the winter freeboard plus 2 inches. For vessels over 330 feet in length it is the winter freeboard.

**§ 43.15–95 Fresh-water freeboard.**

(a) The minimum freeboard in fresh water of unit density is the freeboard obtained by deducting from the minimum freeboard in salt water $\frac{\Delta}{40T}$ inches, where

$\Delta$=displacement in salt water in tons at the summer load waterline, and $T$=tons per inch immersion in salt water at the summer load waterline.

(b) Where the displacement at the summer load waterline cannot be certified, the deduction is to be one-fourth inch per foot of summer draft, measured from the top of the keel to the center of the disk.

**§ 43.15–97 Freeboard table for steamers.**

(a) Table 43.15–97(a) gives the basic minimum summer freeboard for steamers which comply with the standards in this part.

TABLE 43.15–97 (a)—BASIC MINIMUM SUMMER FREEBOARD FOR STEAMERS

| L (feet) | Freeboard (inches) | L (feet) | Freeboard (inches) |
|---|---|---|---|
| 80 | 8.0 | 550 | 116.4 |
| 90 | 9.0 | 560 | 119.1 |
| 100 | 10.0 | 570 | 121.8 |
| 110 | 11.0 | 580 | 124.4 |
| 120 | 12.0 | 590 | 127.0 |
| 130 | 13.0 | 600 | 129.5 |
| 140 | 14.2 | 610 | 132.0 |
| 150 | 15.5 | 620 | 134.4 |
| 160 | 16.9 | 630 | 136.8 |
| 170 | 18.3 | 640 | 139.1 |
| 180 | 19.8 | 650 | 141.4 |
| 190 | 21.4 | 660 | 143.7 |
| 200 | 23.1 | 670 | 145.9 |
| 210 | 24.8 | 680 | 148.1 |
| 220 | 26.6 | 690 | 150.2 |
| 230 | 28.5 | 700 | 152.3 |
| 240 | 30.3 | 710 | 154.4 |
| 250 | 32.3 | 720 | 156.4 |
| 260 | 34.4 | 730 | 158.5 |
| 270 | 36.5 | 740 | 160.5 |
| 280 | 38.7 | 750 | 162.5 |
| 290 | 41.0 | 760 | 164.4 |
| 300 | 43.4 | 770 | 166.3 |
| 310 | 45.9 | 780 | 168.2 |
| 320 | 48.4 | 790 | 170.1 |
| 330 | 51.0 | 800 | 172.0 |
| 340 | 53.7 | 810 | 173.8 |
| 350 | 56.5 | 820 | 175.6 |
| 360 | 59.4 | 830 | 177.4 |
| 370 | 62.4 | 840 | 179.2 |
| 380 | 65.4 | 850 | 180.9 |
| 390 | 68.4 | 860 | 182.6 |
| 400 | 71.5 | 870 | 184.3 |
| 410 | 74.6 | 880 | 186.0 |
| 420 | 77.8 | 890 | 187.7 |
| 430 | 81.0 | 900 | 189.3 |
| 440 | 84.0 | 910 | 190.9 |
| 450 | 87.1 | 920 | 192.5 |
| 460 | 90.2 | 930 | 194.1 |
| 470 | 93.3 | 940 | 195.7 |
| 480 | 96.3 | 950 | 197.3 |
| 490 | 99.3 | 960 | 198.9 |
| 500 | 102.3 | 970 | 200.4 |
| 510 | 105.2 | 980 | 201.9 |
| 520 | 108.1 | 990 | 203.4 |
| 530 | 110.9 | 1,000 | 204.9 |
| 540 | 113.7 | (1) | (1) |

[1] Vessels above 1,000 feet are to be dealt with by the administration.

(b) The minimum freeboards for flush deck steamers are obtained by an addition to Table 43.15–97 (a) at the rate of 1½ inches for every 100 feet of length.

(c) The freeboards at intermediate lengths are obtained by interpolation.

(d) Where $c$ exceeds 0.68, the freeboard is multiplied by the factor

$$\frac{c+0.68}{1.36} \quad (1)$$

(e) Where $D$ exceeds $\frac{L}{15}$ the freeboard is increased by $\left(D-\frac{L}{15}\right)R$ inches, where $R$ is $\frac{L}{130}$ at lengths less than 390 feet, and 3 at 390 feet length and above.

(1) In a vessel with an enclosed superstructure covering at least 0.6$L$ amidships with a complete trunk or with a combination of intact partial superstructures and trunk which extends all fore and aft, where $D$ is less than $\frac{L}{15}$ the freeboard is reduced at the above rate.

(2) Where the height of superstructures or trunk is less than the standard height, the reduction is in the ratio of the actual to the standard height.

(f) Where the actual depth to the surface of the freeboard deck amidships is greater or less than $D$, the difference between the depths (in inches) is added to or deducted from the freeboard.

**§ 43.15–98 Reduced freeboards for steamers having superior design and operational features, and engaged on United States coastwise and/or intercoastal voyages.**

(a) Subject to compliance with the additional conditions in paragraph (b) of this section but otherwise in accordance with the usual conditions of assignment, the freeboards of steamers over 370 feet in length, engaged in U.S. coastwise and/or intercoastal voyages, may be computed from the lesser tabular values given by the Table 43.15–98(a) in lieu of those given by Table 43.15–97(a).

TABLE 43.15–98(a)—REDUCED BASIC MINIMUM SUMMER FREEBOARDS FOR STEAMERS ON UNITED STATES COASTWISE AND/OR INTERCOASTAL VOYAGES

| L (feet) | Freeboard inches | L (feet) | Freeboard inches |
|---|---|---|---|
| 370 | 62.4 | 640 | 126.1 |
| 380 | 64.8 | 650 | 128.1 |
| 390 | 67.2 | 660 | 130.0 |
| 400 | 69.6 | 670 | 131.8 |
| 410 | 72.0 | 680 | 133.6 |
| 420 | 74.5 | 690 | 135.4 |
| 430 | 77.1 | 700 | 137.1 |
| 440 | 79.7 | 710 | 138.8 |
| 450 | 82.3 | 720 | 140.5 |
| 460 | 84.9 | 730 | 142.2 |
| 470 | 87.5 | 740 | 143.8 |
| 480 | 90.0 | 750 | 145.4 |
| 490 | 92.5 | 760 | 146.9 |
| 500 | 95.0 | 770 | 148.4 |
| 510 | 97.5 | 780 | 149.9 |
| 520 | 99.9 | 790 | 151.4 |
| 530 | 102.3 | 800 | 152.8 |
| 540 | 104.7 | 810 | 154.2 |
| 550 | 107.0 | 820 | 155.6 |
| 560 | 109.3 | 830 | 157.0 |
| 570 | 111.5 | 840 | 158.3 |
| 580 | 113.7 | 850 | 159.6 |
| 590 | 115.9 | 860 | 160.9 |
| 600 | 118.0 | 870 | 162.2 |
| 610 | 120.1 | 880 | 163.5 |
| 620 | 122.1 | 890 | 164.8 |
| 630 | 124.1 | 900 | 166.1 |

TABLE 43.15–98(a)—REDUCED BASIC MINIMUM SUMMER FREEBOARDS FOR STEAMERS ON UNITED STATES COASTWISE AND/OR INTERCOASTAL VOYAGES—Continued

| L (feet) | Freeboard inches | L (feet) | Freeboard inches |
|---|---|---|---|
| 910 | 167.3 | 970 | 174.4 |
| 920 | 168.5 | 980 | 175.5 |
| 930 | 169.7 | 990 | 176.6 |
| 940 | 170.9 | 1000 | 177.6 |
| 950 | 172.1 | (1) | (1) |
| 960 | 173.3 | | |

[1] Vessels above 1,000 feet are to be dealt with by the administration.

(b) In order to be eligible for the reduced freeboards permitted by this section, vessels shall comply with the following supplementary conditions:

(1) Weather deck hatch covers shall be of steel construction, sealed watertight, without need for tarpaulins, as provided by § 43.10–5(b). Associated hatch coamings shall be at least of standard height, as provided by § 43.10–10.

(2) Vessels shall be fitted with forecastles having an efficient bulkhead with effective Class 1 or Class 2 closing appliances. Forecastles of standard height or greater shall extend for at least 0.07L. If a forecastle is of less than standard height, but not less than 5.5 feet in height, the product of its length and height, in feet squared, shall be at least equal to 0.50L+50 times the deficiency in height in feet. Forecastles may not be less than 5.5 feet in height for credit under this subparagraph.

(3) Alternatively, vessels not having creditable forecastles but having sufficient excess sheer forward, are eligible for these reduced freeboards. For this purpose the sheer in inches at ⅙L from the forward perpendicular shall be at least 0.089L+8.9+⅘ times the difference between the tabular freeboard obtained from Table 43.15–97(a) and that obtained from Table 43.15–98(a). Similarly, the sheer at the forward perpendicular shall be at least 0.2L+20 plus the difference between the tabular freeboards obtained from Tables 43.15–97(a) and 43.15–98(a).

(4) Vessels shall be subdivided and shall be operated with sufficient stability to maintain a one compartment standard of watertight subdivision and damage stability at drafts up to and including the resulting load draft. For determining compliance with this requirement, the specific standards laid down in Parts 73 and 74 of Subchapter H (Passenger Vessels) of this chapter, as they apply to a required factor of subdivision of 1.0, shall be used, with the exception however, that the cargo space permeabilities specified by §§ 73.10–5(c) and 74.10–15(c) of this chapter shall be suitably increased when the vessel is particularly engaged in the carriage of cargoes which result in a higher value. The related plans, calculations and data, including the stability instructions called for by Subpart 74.20, shall be submitted to the Commandant (MMT), who will then advise the American Bureau of Shipping, or other authorized assigning authority, as to the final acceptability of the subdivision at the proposed draft.

(5) Vessels shall be structurally suitable for the resulting load draft.

## Subpart 43.20—Load Lines for Sailing Vessels [4]

### § 43.20–1 Lines to be used on sailing vessels in connection with the disk.

(a) Winter and tropical load lines are not marked on sailing vessels. The maximum load lines to which sailing vessels may be laden in salt water in winter and in the tropical zone is the center of the disk. (See fig. 43.20–1 (a).)

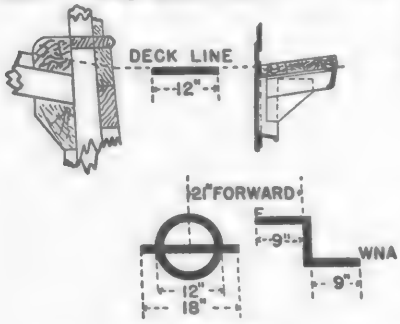



FIGURE 43.20–1 (a)

### § 43.20–5 Conditions of assignment of sailing vessel load lines.

(a) The conditions of assignment for sailing vessels are those contained in §§ 43.10–1—43.10–100.

### § 43.20–10 Computation of freeboard, sailing vessels.

(a) Freeboards are computed from the freeboard table for sailing vessels in the same manner as the freeboards for steamers are computed from the freeboard table for steamers, except as provided by §§ 43.20–15—43.20–45.

### § 43.20–15 Depth for freeboard, sailing vessels (D).

(a) In sailing vessels having a greater rate of rise of floor than 1½ inches per foot, the vertical distance from the top of keel (§ 43.15–7) is reduced by half the difference between the total rise of floor at the half breadth of the vessel and the total rise of 1½ inches per foot; 2½ inches per foot of half breadth is the maximum rate of rise for which a deduction is made.

(b) Where the form at the lower part of the midship section is of a hollow character, or thick garboards are fitted, the depth is measured from the point where the line of the flat of the bottom continued inwards cuts the side of the keel.

(c) The depth used with the freeboard table is to be taken as not less than $\frac{L}{12}$.

[4] The provisions of §§ 43.01–1—43.01–100 and 43.05–1—43.15–97, inclusive, apply to sailing vessels, except as modified by §§ 43.20–1—43.20–45, inclusive.

### § 43.20–20 Coefficient of fineness, sailing vessels (c).

(a) The coefficient used with the freeboard table for sailing vessels is to be taken as not less than 0.62 and not greater than 0.72.

### § 43.20–25 Superstructures in wood sailing vessels.

(a) In wood sailing vessels the construction and closing arrangements of superstructures for which deductions are made from the freeboard are to be to the satisfaction of the assigning authority.

### § 43.20–30 Deductions for sailing vessel superstructures.

(a) Where the effective length of superstructures on sailing vessels is 1.0*L*, the deduction from the freeboard is 3 inches at 80 feet length of vessel, and 28 inches at 330 feet length and above; deductions in intermediate lengths are obtained by interpolation. Where the total effective length of superstructures is less than 1.0*L*, the deduction is a percentage obtained from Table 43.20–30 (a).

TABLE 43.20–30 (a)—TOTAL EFFECTIVE LENGTH OF SUPERSTRUCTURES (E)

| Type of superstructures | 0 | 0.1*L* | 0.2*L* | 0.3*L* | 0.4*L* | 0.5*L* | 0.6*L* | 0.7*L* | 0.8*L* | 0.9*L* | 1.0*L* | Line |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Per-cent* | *Per-cent* | *Per-cent* | *Per-cent* | *Per-cent* | *Per-cent* | *Per-cent* | *Per-cent* | *Per-cent* | *Per-cent* | *Per-cent* | |
| All types without bridge | 0 | 7 | 13 | 17 | 23.5 | 30 | 47½ | 70 | 80 | 90 | 100 | A |
| All types with bridge [1] | 0 | 7 | 14.7 | 22 | 32 | 42 | 56 | 70 | 80 | 90 | 100 | B |

[1] Where the effective length of bridge is less than 0.2*L*, the percentages are obtained by interpolation between lines B and A. Percentages for intermediate lengths of superstructures are obtained by interpolation.

### § 43.20–35 Minimum freeboards for sailing vessels.

(a) No addition to the freeboard is required for winter freeboard, nor is a deduction permitted for tropical freeboard.

(b) An increase in freeboard of 3 inches is made for voyages across the North Atlantic north of latitude 36° N. during the winter months.

(c) In computing the fresh water freeboard for a wood vessel, the draft is measured from the lower edge of the rabbet of keel to the center of the disk.

### § 43.20–40 Freeboard table for sailing vessels.

(a) Table 43.20–40(a) gives the basic minimum summer, winter, and tropical freeboards for iron and steel flush deck sailing vessels, which comply with the standards in this part.

TABLE 43.20–40 (a)—MINIMUM SUMMER, WINTER, AND TROPICAL FREEBOARDS FOR IRON AND STEEL FLUSH DECK SAILING VESSELS

| *L* (feet) | Freeboard | *L* (feet) | Freeboard | *L* (feet) | Freeboard |
|---|---|---|---|---|---|
| | *Inches* | | *Inches* | | *Inches* |
| 80 | 9.2 | 170 | 28.2 | 260 | 50.8 |
| 90 | 11.0 | 180 | 30.6 | 270 | 53.5 |
| 100 | 12.9 | 190 | 33.0 | 280 | 56.3 |
| 110 | 14.9 | 200 | 35.4 | 290 | 59.1 |
| 120 | 17.0 | 210 | 37.9 | 300 | 61.9 |
| 130 | 19.1 | 220 | 40.4 | 310 | 64.7 |
| 140 | 21.3 | 230 | 42.9 | 320 | 67.6 |
| 150 | 23.5 | 240 | 45.5 | 330 | 70.5 |
| 160 | 25.8 | 250 | 48.1 | | |

(b) The freeboards at intermediate lengths are obtained by interpolation.

(c) Where *c* exceeds 0.62 the freeboard is multiplied by the factor

$$\frac{c+0.62}{1.24} \quad (1)$$

(d) Where *D* exceeds $\frac{L}{12}$ the freeboard is increased by

$$\left(D-\frac{L}{12}\right)\times\left(1+\frac{L}{250}\right) \text{ inches.} \quad (2)$$

(e) Where the actual depth to the surface of the freeboard deck amidships is greater or less than *D*, the difference between the depths (in inches) is added to or deducted from the freeboard.

### § 43.20–45 Freeboard for wood sailing vessels.

(a) The freeboard for a wood sailing vessel is the final freeboard the vessel would obtain if she were of iron or steel, with the addition of such penalties as the assigning authority may determine, having regard to the classification, construction, age, and condition of the vessel.

## Subpart 43.25—Load Lines for Steamers Carrying Timber Deck Cargoes [5]

### § 43.25–1 Definitions.

(a) *Timber deck cargo.* The term "timber deck cargo" means a cargo of timber carried on an uncovered part of a freeboard or superstructure deck. The term does not include wood pulp or similar cargo.

(b) *Timber load line.* A timber load line is a special load line to be used only when the vessel is carrying a timber deck cargo in compliance with the requirements in this subpart.

### § 43.25–5 Marks on the vessel's sides; timber cargo; timber load lines.

(a) The lines which indicate the maximum timber load lines in different circumstances and at different seasons are to be horizontal lines, 9 inches in length and 1 inch in breadth, which extend from and are at right angles to, a vertical line marked 21 inches abaft the center of the disk. (See fig. 43.25–5(a).) They are to be marked and verified similarly

[5] The provisions of §§ 43.01–1—43.01–100, inclusive, and §§ 43.05–1—43.15–97, inclusive, also apply to steamers marked to carry timber deck cargoes except as they are modified by §§ 43.25–1—43.30–5, inclusive.

to the ordinary load lines. (See §§ 43.05–20—43.05–30.)

(b) The summer timber load line is indicated by the upper edge of a line marked *"LS."*

(c) The winter timber load line is indicated by the upper edge of a line marked *"LW."*

(d) The winter North Atlantic timber load line is indicated by the upper edge of a line marked *"LWNA."*

(e) The tropical timber load line is indicated by the upper edge of a line marked *"LT."*

(f) The fresh water timber load line in summer is indicated by the upper edge of a line marked *"LF."* The difference between the fresh water timber load line in summer and the summer timber load line is the allowance to be made for loading in fresh water at the other timber load lines. The fresh water timber load line in the tropical zone is

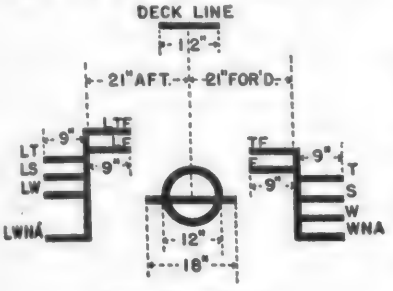



FIGURE 43.25–5 (a)

indicated by the upper edge of a line marked "LTF." [6]

§ 43.25–10 Construction of vessel; timber cargo.

(a) The structure of the vessel is to be of sufficient strength for the deeper draft allowed and for the weight of the deck cargo.

§ 43.25–15 Superstructures; timber cargo.

(a) The vessel is to have a forecastle of at least standard height and at least 7 percent of the length of the vessel, and, in addition, a poop, or a raised quarter deck with a strong steel hood or deckhouse fitted aft.

§ 43.25–20 Machinery casings; timber cargo.

(a) Machinery casings on the freeboard deck are to be protected by a superstructure of at least standard height, unless the machinery casings are of sufficient strength and height to permit of the carriage of timber alongside.

§ 43.25–25 Double bottom tanks; timber cargo.

(a) Double bottom tanks where fitted within the midship half length of the vessel are to have adequate longitudinal subdivision.

[6] Where seagoing steamers navigate a river or inland water, deeper loading is permitted corresponding to the weight of fuel, etc., required for consumption between the point of departure and the open sea.

§ 43.25–30 Bulwarks; timber cargo.

(a) The vessel must be fitted either with permanent bulwarks at least 3 feet 3 inches high, specially stiffened on the upper edge and supported by strong bulwark stays attached to the deck in the way of the beams and provided with necessary freeing ports or with efficient rails of the same height as the above and of specially strong construction.

§ 43.25–35 Deck openings covered by timber deck cargo.

(a) Openings to spaces below the freeboard deck are to be securely closed and battened down. All fittings, such as hatchway beams fore-and-afters, and covers are to be in place. Where hold ventilation is needed, the ventilators are to be efficiently protected.

§ 43.25–40 Stowage; timber cargo.

(a) The wells on the freeboard deck are to be filled with timber stowed as solidly as possible, to at least the standard height of a bridge.

(b) On a vessel within a seasonal winter zone in winter, the height of the deck cargo above the freeboard deck is not to exceed one-third of the extreme breadth of the vessel.

(c) All timber deck cargo is to be compactly stowed, lashed, and secured. It must not interfere in any way with the navigation and necessary work of the vessel, or with the provision of a safe margin of stability at all stages of the voyage, regard being given to additions of weight, such as those due to absorption of water and to losses of weight such as those due to consumption of fuel and stores.

§ 43.25–45 Protection of crew, access to machinery space; timber cargo.

(a) Safe and satisfactory access to the quarters of the crew, to the machinery space, and to all other parts used in the necessary work of the vessel is to be available at all times. Deck cargo in way of openings which give access to such parts is to be so stowed that the openings can be properly closed and secured against the admission of water. Efficient protection for the crew in the form of guardrails, or lifelines, spaced not more than 12 inches apart vertically, is to be provided on each side of the deck cargo to a height of at least 4 feet above the cargo. The cargo is to be made sufficiently level for gangway purposes.

§ 43.25–50 Steering arrangements; timber cargo.

(a) Steering arrangements are to be effectively protected from damage by cargo and, as far as practicable, are to be accessible. Efficient provision is to be made for steering in the event of a breakdown in the main steering arrangements.

§ 43.25–55 Uprights; timber cargo.

(a) Uprights, when required by the nature of the timber, are to be of adequate strength and may be of wood or metal; the spacing is to be suitable for the length and character of timber carried, but is not to exceed 10 feet. Strong angles or metal sockets efficiently secured to the stringer plate or equally efficient means are to be provided for securing the uprights.

§ 43.25–60 Lashings; timber cargo.

(a) Timber deck cargo is to be efficiently secured throughout its length by independent overall lashings spaced not more than 10 feet apart.

(b) Eye plates for these lashings are to be riveted to the sheer strake at intervals of not more than 10 feet, the distance from an end bulkhead of a superstructure to the first eye plate being not more than 6 feet 6 inches. Additional eye plates may be fitted on the stringer plate.

(c) Overall lashings are to be in good condition and are to be not less than three-fourths inch close link chain or flexibile wire rope of equivalent strength, fitted with sliphooks and stretching screws, which are to be accessible at all times. Wire rope lashings are to have a short length of long link chain to permit the length of lashings to be regulated.

(d) When timber is in lengths less than 12 feet, the spacing of the lashings is to be reduced to suit the length of timber or other suitable provision made.

(e) When the spacing of the lashings is 5 feet or less, the size of the lashing may be reduced, but not less than one-half inch chain or equivalent wire rope is to be used.

(f) All fittings required for securing the lashings are to be of strength corresponding to the strength of the lashings.

(g) On superstructure decks, uprights, where fitted, are to be about 10 feet apart and are to be secured by athwartship lashings of ample strength.

§ 43.25–65 Plans; timber cargo.

(a) Plans showing the fittings and arrangements for stowing and securing timber deck cargoes in compliance with the foregoing conditions and §§ 43.25–1—43.25–60 are to be submitted to the assigning authority.

§ 43.25–70 Computation of freeboard; timber cargo.

(a) Where the assigning authority is satisfied that the vessel is suitable and that the conditions and arrangements are at least equal to the foregoing requirements for the carriage of timber deck cargo, the summer freeboards computed in accordance with the rules and tables in §§ 43.15–1—43.15–97, may be modified to give special timber freeboards by substituting the following percentages for those in § 43.15–63:

TABLE 43.25–70 (a)—TOTAL EFFECTIVE LENGTH OF SUPERSTRUCTURES

| | 0 | 0.1*L* | 0.2*L* | 0.3*L* | 0.4*L* | 0.5*L* | 0.6*L* | 0.7*L* | 0.8*L* | 0.9*L* | 1.0*L* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| All types | 20 | 30.75 | 41.5 | 52.25 | 63 | 69.25 | 75.5 | 81.5 | 87.5 | 93.75 | 100 |

(b) The winter timber freeboard is to be obtained by adding to the summer timber freeboard one-third of an inch per foot of the molded summer timber draft.

(c) The winter North Atlantic timber freeboards are the winter North Atlantic freeboards prescribed in § 43.15–93.

(d) The tropical timber freeboard is to be obtained by deducting from the summer timber freeboard one-quarter of an inch per foot of the molded summer timber draft.

CROSS REFERENCE: For requirements for the carriage of timber deck cargo, see §§ 43.25–1—43.25–65.

## Subpart 43.30—Load Lines for Tankers [7]

NOTE: The term "tanker" includes all steamers specially constructed for the carriage of liquid cargoes in bulk.

### § 43.30–1 Tanker load line markings.

(a) Tankers assigned load lines computed in accordance with Table 43.30–70 (a) (valid for both United States' domestic and international voyages) shall be marked as provided by §§ 43.05–5 to 43.05–30, inclusive, and as shown in Figure 43.05–5(a).

(b) Tankers assigned load lines computed in accordance with Table 43.30–75 (a) (valid only for United States coastwise and/or intercoastal voyages) shall be marked abaft the disk as shown in Figure 43.05–15(d).

(c) Tankers marked in accordance with paragraph (b) of this section but which may also engage in foreign voyages may carry both the markings called for by paragraphs (a) and (b) of this section when on United States coastwise and/or intercoastal voyages, except that, in such cases, the line through the center of the disk shall correspond to the summer load line computed in accordance with Table 43.30–70(a). Tankers departing on foreign voyages shall only bear the marks forward of the disk called for by paragraph (a) of this section.

### § 43.30–5 Construction of tanker.

(a) The structure of the vessel is to be of sufficient strength for the increased draft corresponding to the freeboard assigned.

### § 43.30–10 Forecastle; tanker.

(a) The vessel is to have a forecastle of which the length is not less than 7 percent of the length of the vessel and the height is not less than the standard height.

### § 43.30–15 Machinery casings; tanker.

(a) The openings in machinery casings on the freeboard deck are to be fitted with steel doors. The casings are to be protected by an enclosed poop or bridge of at least standard height or by a deckhouse of equal height and of equivalent strength. The bulkheads at the ends of these structures are to be of the scantlings required for bridge front bulkheads. All entrances to the structures from the freeboard deck at to be fitted with effective closing appliances and the sills are to be at least 18 inches above the deck. Exposed machinery casings on the superstructure deck are to be of substantial construction, and all openings in them are to be fitted with steel closing appliances permanently attached to the casings and capable of being closed and secured from both sides; the sills of such openings are to be at least 15 inches above the deck. Fiddley openings are to be as high above the superstructure deck as is reasonable and practicable and are to have strong steel covers permanently attached in their proper positions.

### § 43.30–20 Gangway; tanker.

(a) An efficiently constructed permanent gangway of sufficient strength for its exposed position is to be fitted fore and aft at the level of the superstructure deck between the poop and midship bridge, and when crew are berthed forward, from the bridge to the forecastle, or other equivalent means of access may be provided to carry out the purpose of the gangway, such as passages below deck.

### § 43.30–25 Protection of crew; access to machinery space; tanker.

(a) Safe and satisfactory access from the gangway level to the quarters of the crew, the machinery space, and all other parts used in the necessary work of the vessel is to be available at all times. This section does not apply to pumprooms entered from the freeboard deck, when fitted with class 1 closing appliances.

CROSS REFERENCE: For class 1 closing appliances, see § 43.15–37.

### § 43.30–30 Hatchways; tanker.

(a) All exposed hatchways on the freeboard deck and on the deck of expansion trunks are to be closed watertight by efficient steel covers. Hatchways on the freeboard deck within a forecastle which is closed at the after end with a bulkhead and closing appliances no less effective than Class 2 may be fitted with wood covers, coamings, and closing appliances in accordance with § 43.10–55, provided hatchways on the forecastle deck are closed watertight by efficient steel covers.

### § 43.30–35 Ventilators; tanker.

(a) Ventilators to spaces below the freeboard deck are to be of ample strength or are to be protected by superstructures or equally efficient means.

### § 43.30–40 Freeing arrangements; tanker.

(a) Vessels with bulwarks are to have open rails fitted for at least half the length of the exposed portion of the weather deck or other effective freeing arrangements. The upper edge of the sheer strake is to be kept as low as practicable and preferably not higher than the upper edge of the gunwale bar.

(b) Where superstructures are connected by trunks, open rails are to be fitted for the whole length of the weather portions of the freeboard deck.

### § 43.30–45 Plans; tanker.

(a) Plans showing proposed fittings and arrangements are to be submitted to the assigning authority for approval.

### § 43.30–50 Computation of freeboard; tanker.

(a) When the assigning authority is satisfied that the foregoing requirements are fulfilled, the summer freeboard may be computed from the table for tankers; all corrections except those for flushdeck steamers, detached superstructures, excess sheer, and winter voyages across the North Atlantic are to be made in accordance with §§ 43.15–1—43.15–97.

### § 43.30–55 Deductions for detached superstructures; tankers.

(a) When the total effective length of superstructure is less than 1.0*L*, the deduction is a percentage of that for a superstructure of length 1.0*L*, and is obtained from Table 43.30–55(a).

TABLE 43.30–55 (a)—TOTAL EFFECTIVE LENGTH OF SUPERSTRUCTURES

| | 0 | 0.1*L* | 0.2*L* | 0.3*L* | 0.4*L* | 0.5*L* | 0.6*L* | 0.7*L* | 0.8*L* | 0.9*L* | 1.0*L* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| All types | 0 | 7 | 14 | 21 | 31 | 41 | 52 | 63 | 75.3 | 87.7 | 100 |

### § 43.30–60 Deduction for excess sheer; tanker.

(a) Where the sheer is greater than the standard, the correction for excess sheer (see § 43.15–73) is deducted from the freeboard for all tankers. Section 43.15–77 does not apply except that the maximum deduction for excess sheer is 1½ inches at 100 feet and increases at the rate of 1½ inches for each additional 100 feet in the length of the vessel.

### § 43.30–65 Winter North Atlantic freeboard; tanker.

(a) The minimum freeboard for tankers on voyages across the North Atlantic from a port or place of departure north of latitude 36° N. to a port or place of arrival north of latitude 36° N., regardless of the route of the vessel while it is in either of the northern seasonal winter zones during the winter season, shall be the winter freeboard plus an addition at a rate of one inch per 100 feet in length.

### § 43.30–70 Freeboard table for tankers.

(a) Table 43.30–70(a) gives the basic minimum summer freeboard for tankers which comply with the standards in this part.

[7] The provisions of §§ 43.01–1—43.01–100, inclusive, and §§ 43.05–1—43.05–97, inclusive also apply to tankers except as they are modified by §§ 43.30–1—43.30–70, inclusive.

TABLE 43.30-70(a)—BASIC MINIMUM FREEBOARD FOR TANKERS

| L (feet) | Freeboard (inches) | L (feet) | Freeboard (inches) |
|---|---|---|---|
| 190 | 21.5 | 610 | 110.1 |
| 200 | 23.1 | 620 | 111.7 |
| 210 | 24.7 | 630 | 113.1 |
| 220 | 26.3 | 640 | 114.5 |
| 230 | 28.0 | 650 | 115.9 |
| 240 | 29.7 | 660 | 117.3 |
| 250 | 31.5 | 670 | 118.6 |
| 260 | 33.3 | 680 | 119.9 |
| 270 | 35.2 | 690 | 121.2 |
| 280 | 37.1 | 700 | 122.5 |
| 290 | 39.1 | 710 | 123.7 |
| 300 | 41.1 | 720 | 124.9 |
| 310 | 43.1 | 730 | 126.1 |
| 320 | 45.1 | 740 | 127.3 |
| 330 | 47.1 | 750 | 128.5 |
| 340 | 49.2 | 760 | 129.6 |
| 350 | 51.3 | 770 | 130.7 |
| 360 | 53.5 | 780 | 131.8 |
| 370 | 55.7 | 790 | 132.9 |
| 380 | 57.9 | 800 | 134.0 |
| 390 | 60.2 | 810 | 135.1 |
| 400 | 62.5 | 820 | 136.2 |
| 410 | 64.9 | 830 | 137.2 |
| 420 | 67.4 | 840 | 138.2 |
| 430 | 69.9 | 850 | 139.2 |
| 440 | 72.5 | 860 | 140.1 |
| 450 | 75.1 | 870 | 141.0 |
| 460 | 77.7 | 880 | 141.9 |
| 470 | 80.2 | 890 | 142.8 |
| 480 | 82.7 | 900 | 143.7 |
| 490 | 85.1 | 910 | 144.5 |
| 500 | 87.5 | 920 | 145.3 |
| 510 | 89.8 | 930 | 146.1 |
| 520 | 92.1 | 940 | 146.9 |
| 530 | 94.3 | 950 | 147.7 |
| 540 | 96.5 | 960 | 148.5 |
| 550 | 98.6 | 970 | 149.2 |
| 560 | 100.7 | 980 | 149.8 |
| 570 | 102.7 | 990 | 150.4 |
| 580 | 104.6 | 1,000 | 151.0 |
| 590 | 106.5 | (1) | (1) |
| 600 | 108.4 | | |

[1] Vessels above 1,000 feet are to be dealt with by the Administration.

### § 43.30–75 Freeboard table for tankers on United States coastwise and/or intercoastal voyages.

(a) Tankers which are structurally qualified to be operated at the resulting deeper drafts may be assigned load lines, valid only for United States coastwise and/or intercoastal voyages, which have been computed on the basis of Table 43.30–75(a) in lieu of Table 43.30–70(a).

TABLE 43.30-75(a)—BASIC MINIMUM FREEBOARD FOR TANKERS ON UNITED STATES COASTWISE AND/OR INTERCOASTAL VOYAGES

| L | Freeboard | L | Freeboard | L | Freeboard |
|---|---|---|---|---|---|
| Feet | Inches | Feet | Inches | Feet | Inches |
| (1) | (1) | 540 | 88.7 | 780 | 127.6 |
| 310 | 43.0 | 550 | 90.7 | 790 | 128.8 |
| 320 | 44.7 | 560 | 92.7 | 800 | 130.0 |
| 330 | 46.3 | 570 | 94.7 | 810 | 131.1 |
| 340 | 47.9 | 580 | 96.6 | 820 | 132.2 |
| 350 | 49.5 | 590 | 98.5 | 830 | 133.3 |
| 360 | 51.1 | 600 | 100.3 | 840 | 134.4 |
| 370 | 52.7 | 610 | 102.1 | 850 | 135.5 |
| 380 | 54.4 | 620 | 103.9 | 860 | 136.5 |
| 390 | 56.3 | 630 | 105.7 | 870 | 137.5 |
| 400 | 58.3 | 640 | 107.4 | 880 | 138.5 |
| 410 | 60.4 | 650 | 109.1 | 890 | 139.5 |
| 420 | 62.5 | 660 | 110.8 | 900 | 140.5 |
| 430 | 64.6 | 670 | 112.4 | 910 | 141.5 |
| 440 | 66.8 | 680 | 114.0 | 920 | 142.4 |
| 450 | 69.0 | 690 | 115.5 | 930 | 143.3 |
| 460 | 71.3 | 700 | 117.0 | 940 | 144.3 |
| 470 | 73.5 | 710 | 118.4 | 950 | 145.2 |
| 480 | 75.7 | 720 | 119.8 | 960 | 146.1 |
| 490 | 77.9 | 730 | 121.2 | 970 | 147.0 |
| 500 | 80.1 | 740 | 122.6 | 980 | 147.8 |
| 510 | 82.3 | 750 | 123.9 | 990 | 148.6 |
| 520 | 84.5 | 760 | 125.2 | 1,000 | 149.4 |
| 530 | 86.6 | 770 | 126.4 | (2) | (2) |

[1] For vessels up to 300 feet the freeboards given by Table 43.30-70(a) apply.
[2] Vessels above 1,000 feet are to be specially considered.

## Subpart 43.35—Lumber Schooners

### § 43.35–1 Load line marks for vessels specially constructed for the carriage of complete cargoes of timber (lumber schooner type).

(a) Load lines for existing vessels propelled by either sail or steam which have been specially constructed to carry complete cargoes of timber (that is, of the lumber schooner type) when carrying a complete cargo of timber will be marked with a load line as provided in § 43.01–15. The mark is illustrated by figure 43.35–1(a).

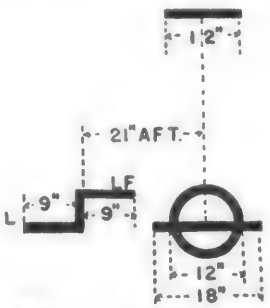



FIGURE 43.35–1 (a).—Timber load line for vessels constructed for the carriage of complete cargoes of timber.

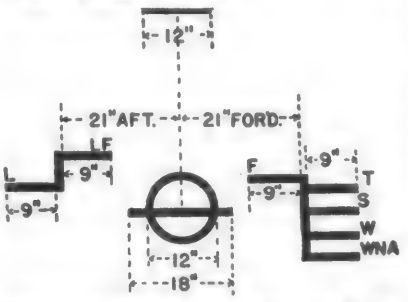



FIGURE 43.35–1 (b).—Timber load line in conjunction with steamer load line for vessels constructed for the carriage of complete cargoes of timber.

(b) Existing vessels which have been specially constructed to carry complete cargoes of timber (the lumber schooner type) and which carry cargoes other than complete timber cargoes, will be marked as provided in § 43.01–15, the marking is illustrated by figure 43.35–1 (b).

(c) The forward mark will be determined as provided in §§ 43.15–1—43.15–97 or §§ 43.20–1—43.20–45, as applicable to the type of vessel dealt with.

## Subpart 43.40—Zones and Seasonal Areas and Miscellaneous Requirements

### § 43.40–1 Boundaries of the zones and seasonal areas.

(a) The southern boundary of the northern "winter seasonal" zone is a line drawn from the east coast of North America along the parallel of latitude 36° N. to Tarifa, in Spain; from the east coast of Korea along the parallel of latitude 35° N. to the west coast of Honshu, Japan; from the east coast of Honshu along the parallel of latitude 35° N. to longitude 150° W., and thence along a rhumb line to the west coast of British Columbia at latitude 55° N., Fusan (Korea) and Yokohama to be considered as being on the boundary line of the northern "winter seasonal" zone and the "summer" zone.

(b) The northern boundary of the "tropical" zone is a line drawn from the east coast of South America at lat. 10° N. along the parallel of lat. 10° N. to long. 20° W., thence north to lat. 20° N. and thence along the parallel of lat. 20° N. to the West Coast of Africa; a line from the east coast of Africa along the parallel of lat. 8° N. to the west coast of the Malay Peninsula, following thence the coast of Malay and Siam to the east coast of Cochin China at lat. 10° N., thence along the parallel of lat. 10° N. to long. 145° E., thence north to lat. 13° N. and thence along the parallel of lat. 13° N. to the west coast of Central America, Saigon to be considered as being on the boundary line of the "tropical" zone and the "seasonal tropical" area (4).

(c) The southern boundary of the "tropical" zone is a line drawn from the east coast of South America along the Tropic of Capricorn to the West Coast of Africa; from the east coast of Africa along the parallel of lat. 20° S. to the west coast of Madagascar, thence along the west and north coast of Madagascar to long. 50° E., thence north to lat. 10° S., thence along the parallel of lat. 10° S. to long. 110° E., thence along a rhumb line to Port Darwin, Australia, thence eastward along the coast of Australia and Wessel Island to Cape Wessel, thence along the parallel of lat. 11° S. to the west side of Cape York from the east side of Cape York at lat. 11° S. along the parallel of lat. 11° S. to long. 150° W., thence along a rhumb line to the point lat. 26° S., long. 75° W., and thence along a rhumb line to the west coast of South America at lat. 30° S., Coquimbo, Rio de Janeiro, and Port Darwin to be considered as being on the boundary line of the "tropical" and "summer" zones.

(d) The following regions are to be included in the "tropical" zone:

(1) The Suez Canal, the Red Sea, and the Gulf of Aden, from Port Said to the meridian of 45° E., Aden and Berbera to be considered as being on the boundary line of the "tropical" zone and the "seasonal tropical" area 2 (ii).

(2) The Persian Gulf to the meridian of 59° E.

(e) The northern boundary of the southern "winter seasonal" zone is a line drawn from the east coast of South America along the parallel of latitude 40° S. to longitude 56° W., thence along a rhumb line to the point latitude 34° S., longtitude 50° W., thence along the parallel of latitude 34° S. to the west coast of South Africa; from the east coast of South Africa at latitude 30° S. along a rhumb line to the point latitude 35°30′ S., longitude 118° E., off the southern coast of Australia, thence along a rhumb line to Cape Grim, Tasmania, thence along the north coast of Tasmania to Eddystone Point, thence along a rhumb line to the west coast of South Island, New Zealand, at longitude 170° E., thence along the west, south, and

east coasts of South Island to Cape Saunders, thence along a rhumb line to the point latitude 33° S., longitude 170° W.; and thence along the parallel of latitude 33° S. to the west coast of South America, Valparaiso, Capetown, and Durban to be considered as being on the boundary line of the Southern "seasonal winter" and "summer" zones.

(f) The remaining areas constitute the "summer" zones. The following areas are seasonal tropical areas:

(1) In the North Atlantic Ocean: An area bounded on the north by a line from Capa Catoche in Yucatan to Cape San Antonio in Cuba, by the South Cuban Coast to lat. 20° N. and by the parallel of lat. 20° N. to the point lat. 20° N., long. 20° W., on the west by the coast of Central America; on the south by the north coast of South America and by parallel of lat. 10° N., and on the east by the meridian of 20° W.

Tropical: 1st November to 15th July.
Summer: 16th July to 31st October.

(2) Arabian Sea: (i) North of lat. 24° N. Karachi is to be considered as being on the boundary line of this area and the seasonal tropical area below.

Tropical: 1st August to 20th May.
Summer: 21st May to 31st July.

(ii) South of lat. 24° N.

Tropical: 1st December to 20th May, and 16th September to 15th October.
Summer: 21st May to 15th September and 16th October to 30th November.

(3) Bay of Bengal:

Tropical: 16th December to 15th April.
Summer: 16th April to 15th December.

(4) In the China Sea: An area bounded on the west and north by the coast of Indo-China and China to Hong Kong, on the east by a rhumb line to the port of Sual (Luzon Island), and by the west coast of the Islands of Luzon, Samar, and Leyte to the parallel of 10° N., and on the south by the parallel of lat. 10° N., Hong Kong and Sual to be considered as being on the boundary of the "seasonal tropical" and "summer" zones.

Tropical: 21st January to 30th April.
Summer: 1st May to 20th January.

(5) In the north Pacific Ocean: (i) An area bounded on the north by the parallel of lat. 25° N., on the west by the meridian of 160° E., on the south by the parallel of lat. 13° N., and on the east by the meridian of 130° W.

Tropical: 1st April to 31st October.
Summer: 1st November to 31st March.

(ii) An area bounded on the north and east by the coast of California, Mexico, and Central America, on the west by the meridian of 120° W., and by a rhumb line from the point lat. 30° N., long. 120° W., to the point lat. 13° N., long. 105° W., and on the south by the parallel of lat. 13° N.

Tropical: 1st March to 30th June and 1st to 30th November.
Summer: 1st July to 31st October and 1st December to 28th/29th February.

(6) In the south Pacific Ocean: (i) An area bounded on the north by the parallel of lat. 11° S., on the west by the east coast of Australia, on the south by the parallel of lat. 20° S., and on the east by the meridian of 175° E., together with the Gulf of Carpentaria south of lat. 11° S. Mackay is to be considered as being on the boundary of the "seasonal tropical" and the "summer" zones.

Tropical: 1st April to 30th November.
Summer: 1st December to 31st March.

(ii) An area bounded on the west by the meridian of 150° W., on the south by the parallel of lat. 20° S., and on the north and east by the rhumb line forming the southern boundary of the tropical zone.

Tropical: 1st March to 30th November.
Summer: 1st December to 28/29th February.

(g) The following are seasonal winter areas: (1) Northern seasonal winter zone (between North America and Europe). (i) In the area within and to the northwards of the following line: A line drawn south from the coast of Greenland at long. 50° W. to lat. 45° N., thence along the parallel of lat. 45° N. to the meridian of 15° W., thence north to lat. 60° N., thence along the parallel of lat. 60° N. to the west coast of Norway, Bergen to be considered as being on the boundary line of this area and area subdivision (ii) of this subparagraph.

Winter: 16th October to 15th April.
Summer: 16th April to 15th October.

(ii) An area outside area subdivision (i) of this subparagraph and north of the parallel of lat. 36° N.

Winter: 1st November to 31st March.
Summer: 1st April to 31st October.

(2) Baltic (bounded by the parallel of latitude of the Skaw).

Winter: 1st November to 31st March.
Summer: 1st April to 31st October.

(3) Mediterranean and Black Sea.

Winter: 16th December to 15th March.
Summer: 16th March to 15th December.

(4) Northern "seasonal winter" zone (between Asia and North America, except Sea of Japan), south of 50° N.

Winter: 16th October to 15th April.
Summer: 16th April to 15th October.

(5) Sea of Japan between the parallels of lat. 35° N. and 50° N.

Winter: 1st December to 28th/29th February.
Summer: 1st March to 30th November.

(6) Southern "seasonal winter" zone.

Winter: 16th April to 15th October.
Summer: 16th October to 15th April.

**§ 43.40–5 Fees, travel expense.**

(a) *Scale of fees.* (1) Subject to the conditions as set forth in this paragraph, fees payable by owners will be charged for assignment of load line (including load line and condition survey, verification of markings and issuance of load line certificates) in accordance with Table 43.40–5 (a).

TABLE 43.40–5 (a)—FEES FOR ASSIGNMENT OF LOAD LINE

| Size of vessel | Classed vessel [1] | Unclassed vessels |
|---|---|---|
| Under 200 gross tons | $30.00 | $100.00 |
| 200 and under 400 gross tons | 30.00 | 125.00 |
| 400 and under 700 gross tons | 35.00 | 155.00 |
| 700 and under 1,000 gross tons | 40.00 | 190.00 |
| 1,000 and under 1,500 gross tons | 40.90 | 230.00 |
| 1,500 and under 2,500 gross tons | 50.00 | 270.00 |
| 2,500 and under 3,500 gross tons | 60.00 | 310.00 |
| 3,500 and under 5,000 gross tons | 70.00 | 350.00 |
| 5,000 and under 6,500 gross tons | 85.00 | 390.00 |
| 6,500 and under 8,000 gross tons | 100.00 | 430.00 |
| 8,000 and under 10,000 gross tons | 110.00 | 470.00 |
| 10,000 and under 12,000 gross tons | 120.00 | 510.00 |
| 12,000 and under 15,000 gross tons | 130.00 | 550.00 |
| 15,000 gross tons and above | 140.00 | 590.00 |

[1] Classed vessel means vessel in class with the assigning authority.

(2) In the case of unclassed vessels newly built, where an extensive review of construction plans and attendance during construction by the Surveyors of the assigning authority may be required, in the case of existing unclassed vessels where necessary plans are not available, and in cases where alterations or repairs are made, which would require more than a normal attendance by the Surveyors, additional fees proportional to the amount of work involved may be charged.

(3) The provisions of this paragraph may be applied to either classed or unclassed vessels in cases where, due to alterations or changes in service, a new freeboard may be required.

(b) *Fees for renewal of load line certificates.* (1) For unclassed vessels the fees for condition survey and renewal of load line certificates shall be 50 percent of the scale in paragraph (a) of this section. In cases where alterations or repairs are made which would require more than a normal attendance by the Surveyors, additional fees, proportional to the amount of work involved may be charged.

(2) For classed vessels where the survey is carried out in conjunction with a survey required for maintenance of class and for which a fee is chargeable, no charge will be made for the survey, but an amount not exceeding $25 for the issuance of the new load line certificate may be charged.

(c) *Fees for annual load line inspection.* The fee for annual load line inspection shall be $25 for vessels not exceeding 2,000 gross tons, and $35 for vessels of more than 2,000 gross tons. Where alterations or repairs are made, which would require more than a normal attendance by the Surveyors, additional fees proportional to the work involved may be charged. In the case of a classed vessel no charge will be made for this inspection if carried out at the same time as a survey to the hull that is required for maintenance of class and for which a fee is chargeable.

(d) *Traveling expenses.* For all traveling expenses incurred in connection with the surveys described in this section there will be an additional charge.

§ 43.40–10 Forms of load line certificates.

INTERNATIONAL LOAD LINE CERTIFICATE

[Form A1]

Issued under the authority of the United States of America, Commandant, U. S. Coast Guard, under the provisions of the International Load Line Convention, 1930.

[SEAL]

Issued by _____

Certificate No. _____ Official No. _____

Name of ship _____ Gross tonnage _____

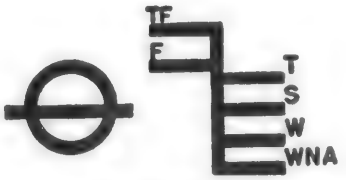
Port of registry _____

| FREEBOARD FROM DECK LINE | | LOAD LINE |
|---|---|---|
| Tropical | (T) | Above (S) |
| Summer | (S) | Upper edge of line through center of disk. |
| Winter | (W) | Below (S) |
| Winter (North Atlantic) | (WNA) | Below (S) |

*Allowance for fresh water for all freeboards _____

(All measurements are to upper edges of the respective horizontal lines)

The upper edge of the deck line from which these freeboards are measured is _____ inches above the top of the _____ deck at side.




This is to certify that this ship has been surveyed and the freeboards and load lines shown above have been assigned in accordance with the Convention.

**This certificate remains in force until _____ issued at _____ on the _____ day of _____, 19____.

(Here follows the signature or seal and description of the assigning authority.)

NOTES: (1) In accordance with the Load Line Regulations, the disk and lines must be permanently marked by center punch marks or cutting. Letters indicating the assigning authority are to be marked alongside the disk and above the center line. Periodic inspections are to be made at intervals of approximately twelve months.

(2) The load line assignment given by this certificate necessarily assumes that the nature and stowage of cargo, ballast, etc., are such as to secure sufficient stability for the vessel. Accordingly, it is the owner's responsibility to furnish the Master of the vessel with stability information and instructions when this is necessary to maintenance of sufficient stability.

(On the reverse side of the load line certificate or on a separate sheet attached and forming part of the certificate, provision is to be made for annual inspection and renewal endorsements.)

(Reverse side of certificate)

ANNUAL INSPECTIONS

I have surveyed this ship for the purpose of seeing whether this certificate should remain in force and the survey has been completed to my satisfaction.

_____ _____ _____
(Signature of Surveyor) (Place) (Date)

I have surveyed this ship for the purpose of seeing whether this certificate should remain in force and the survey has been completed to my satisfaction.

_____ _____ _____
(Signature of Surveyor) (Place) (Date)

I have surveyed this ship for the purpose of seeing whether this certificate should remain in force and the survey has been completed to my satisfaction.

_____ _____ _____
(Signature of Surveyor) (Place) (Date)

I have surveyed this ship for the purpose of seeing whether this certificate should remain in force and the survey has been completed to my satisfaction.

_____ _____ _____
(Signature of Surveyor) (Place) (Date)

RENEWAL OF LOAD LINE CERTIFICATE

The provisions of the Convention being fully complied with by this ship, this certificate is renewed until _____, 19___.

Place _____

Date _____

ASSIGNING AUTHORITY

By _____
(Surveyor)

NOTES

1. The Winter North Atlantic Load Line applies for voyages across the North Atlantic Ocean north of latitude 36° N., during the winter months as defined by the Load Line Regulations. The periods during which the other seasonal load lines apply in different parts of the world are as stated in the Load Line Regulations.

2. This Load Line Certificate will be canceled by the Commandant, U. S. Coast Guard, if—

(a) The periodic inspections have not been carried out.

(b) Material alterations have been made to the hull or superstructures which would affect the calculations determining the position of the load lines.

(c) The fittings and appliances for the protection of the openings, guardrails, freeing ports, or the means of access to the crew's quarters have not been maintained in as effective a condition as they were when the Certificate was issued.

3. When this Certificate has expired or been canceled, it must be delivered to the Assigning Authority.

APPLIANCES FOR CLOSING ACCESS OPENINGS IN BULKHEADS AT ENDS OF DETACHED SUPERSTRUCTURES

Forecastle _____

Bridge, fore end _____

Bridge, after end _____

Poop _____

TEMPORARY APPLIANCES FOR CLOSING OPENINGS IN SUPERSTRUCTURE DECKS

_____

_____

*Where seagoing steamers navigate a river or inland water, deeper loading is permitted corresponding to the weight of fuel, etc., required for consumption between the point of departure and the open sea.

**At the expiration of this certificate, renewal should be obtained in accordance with the Load Line Regulations and if upon examination the ship is found to be in a satisfactory condition, this certificate will be extended and so endorsed on the reverse side.

INTERNATIONAL LOAD LINE CERTIFICATE

[Form A2]

Issued under the authority of the United States of America, Commandant, U. S. Coast Guard, under the provisions of the International Load Line Convention, 1930.

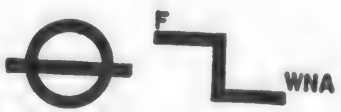
[SEAL]

Issued by _____
Certificate No. _____
Name of ship _____
Port of registry _____ Official No. _____
Gross tonnage _____

| FREEBOARD FROM DECK LINE | | LOAD LINE |
|---|---|---|
| Tropical<br>Summer<br>Winter | _____ | Upper edge of line through center of disk. |
| Winter—North Atlantic | (WNA) | Upper edge of line below center of disk. |
| Allowance for fresh water for all freeboards | | |

(All measurements are to upper edges of the respective horizontal lines)

The upper edge of the deck line from which these freeboards are measured is _____ inches above the top of the _____ deck at side.




This is to certify that this ship has been surveyed and the freeboards and load lines shown above have been assigned in accordance with the Convention.

*This certificate remains in force until _____
Issued at _____ on the _____ day of _____, 19__.

(Here follows the signature or seal and description of the assigning authority.)

NOTES: (1) In accordance with the Load Line Regulations, the disk and lines must be permanently marked by center punch marks or cutting. Letters indicating the assigning authority are to be marked alongside the disk and above the centerline. Periodic inspections are to be made at intervals of approximately twelve months.

(2) The load line assignment given by this certificate necessarily assumes that the nature and stowage of cargo, ballast, etc., are such as to secure sufficient stability for the vessel. Accordingly, it is the owner's responsibility to furnish the Master of the vessel with stability information and instructions when this is necessary to maintenance of sufficient stability.

(On the reverse side of the load line certificate, or on a separate sheet attached and forming part of the certificate, provision is to be made for annual inspection and renewal endorsements.)

(Reverse side of certificate to be prepared with notes and for endorsements as set forth for Form A1.)

*At the expiration of this certificate, renewal should be obtained in accordance with the Load Line Regulations and if upon examination the ship is found to be in a satisfactory condition, this certificate will be extended and so endorsed on the reverse side.

INTERNATIONAL LOAD LINE CERTIFICATE

[Form A3]

Issued under the authority of the United States of America, Commandant, U. S. Coast Guard, under the provisions of the International Load Line Convention, 1930.

[SEAL]

Issued by _____
Certificate No. _____
Name of ship _____ Official No. _____
Port of registry _____ Gross tonnage _____

| FREEBOARDS FROM DECK LINE | | LOAD LINE |
|---|---|---|
| Tropical | (T) | _____ Above (S) |
| Summer | (S) | Upper edge of line through center of disk. |
| Winter | (W) | _____ Below (S) |
| Winter (North Atlantic) | (WNA) | _____ Below (S) |
| *Allowance for fresh water for all freeboards | | |

The timber freeboards given in this certificate are applicable only when this ship carries a timber deck cargo and complies with the special requirements of the Load Line Regulations regarding timber deck cargoes.

| FREEBOARDS FROM DECK LINE | | LOAD LINE |
|---|---|---|
| Tropical (Timber) | (LT) | _____ Above (S) |
| Summer (Timber) | (LS) | _____ Above (S) |
| Winter (Timber) | (LW) | _____ Above (S) |
| Winter North Atlantic (Timber) | (LWNA) | _____ Below (S) |

(All measurements are to upper edges of the respective horizontal line)

The upper edge of the deck line from which these freeboards are measured is _____ inches above the top of the _____ deck at side.

This is to certify that this ship has been surveyed and the freeboards and load lines shown above have been assigned in accordance with the Convention.

LOAD LINE REGULATIONS

**This certificate remains in force until _____
Issued at _____ on the _____ day of _____, 19__.

(Here follows the signature or seal and description of the assigning authority.)

*Where seagoing steamers navigate a river or inland water, deeper loading is permitted corresponding to the weight of fuel, etc., required for consumption between the point of departure and the open sea.

**At the expiration of this certificate, renewal should be obtained in accordance with the Load Line Regulations and if upon examination the ship is found to be in a satisfactory condition, this certificate will be extended and so indorsed on the reverse side.

NOTES: (1) In accordance with the Load Line Regulations, the disk and lines must be permanently marked by center punch marks or cutting. (The diagram showing the timber load line marks is to be inserted above by the assigning authority.) Letters indicating the assigning authority are to be marked alongside the disk and above the center line. Periodic inspections are to be made at intervals of approximately twelve months.

(2) The load line assignment given by this certificate necessarily assumes that the nature and stowage of cargo, ballast, etc., are such as to secure sufficient stability for the vessel. Accordingly, it is the owner's responsibility to furnish the Master of the vessel with stability information and instructions when this is necessary to maintenance of sufficient stability.

(On the reverse side of the load line certificate, or on a separate sheet attached and forming part of the certificate, provision is to be made for annual inspection and renewal endorsements.)

(Reverse side of certificate to be prepared with notes and for endorsements as set forth for Form A1.)

LOAD LINE CERTIFICATE

[Form B]

(To be issued to foreign vessels belonging to countries that have not ratified or acceded to the International Load Line Convention, 1930.)

Issued under the authority of the United States of America, Commandant, U. S. Coast Guard, under the provisions of the Load Line Act of March 2, 1929, as amended.

[SEAL]

Issued by _____

Certificate No. _____

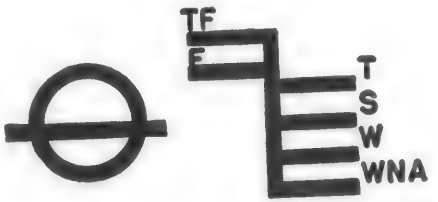
Name of ship _____ Official No. _____

Port of registry _____ Gross tonnage _____

| FREEBOARD FROM DECK LINE | | LOAD LINE |
|---|---|---|
| Summer in tropical seas | (T) | _____ Above (S) |
| Summer | (S) | Upper edge of line through center of disk. |
| Winter | (W) | _____ Below (S) |
| Winter in North Atlantic | (WNA) | _____ Below (S) |

*Allowance for fresh water for all freeboards _____

The upper edge of the deck line from which these freeboards are measured is _____ inches above the top of the _____ deck at side.




*Where seagoing steamers navigate a river or inland water, deeper loading is permitted corresponding to the weight of fuel, etc., required for consumption between the point of departure and the open sea.

This is to certify that this ship has been surveyed and the freeboards and load lines shown above have been found to be correctly marked upon the vessel in manner and location as provided by the load line regulations of the Commandant, U. S. Coast Guard.

**This certificate remains in force until _____ on the _____ day of _____, 19__

Issued at _____

(Here follows the signatures or seal and the description of the authority issuing the certificate.)

NOTES: (1) In accordance with the Load Line Regulations, the disk and lines must be permanently marked by center punch marks or cutting. Letters indicating the assigning authority are to be marked alongside the disk and above the centerlines. This certificate is limited to 1 year and must be renewed annually.

(2) The load line assignment given by this certificate necessarily assumes that the nature and stowage of cargo, ballast, etc., are such as to secure sufficient stability for the vessel. Accordingly, it is the owner's responsibility to furnish the Master of the vessel with stability information and instructions when this is necessary to maintenance of sufficient stability.

(On the reverse side of the load line certificate, or on a separate sheet attached and forming part of the certificate, provision is to be made for renewal endorsements.)

(Reverse side of certificate)

RENEWAL OF LOAD LINE CERTIFICATE

The provisions of the regulations of the Commandant, U. S. Coast Guard, determining load lines being fully complied with by this ship, this certificate is renewed till_____

_____ Place_____ Date_____

Signature or seal and description of assigning authority.

The provisions of the regulations of the Commandant, U. S. Coast Guard, determining load lines being fully complied with by this ship, this certificate is renewed till _____

_____ Place_____ Date_____

Signature or seal and description of assigning authority.

NOTES

1. The Winter North Atlantic Load Line applies for voyages across the North Atlantic Ocean north of latitude 36° N., during the winter months as defined by the Load Line Regulations. The periods during which the other seasonal load lines apply in different parts of the world are as stated in the Load Line Regulations.

2. This Load Line Certificate will be canceled by the Commandant, U. S. Coast Guard if—

(a) Material alterations have been made to the hull or superstructure which would affect the calculations determining the position of the load lines.

(b) The fittings and appliances for the protection of the openings, guardrails, freeing ports, or the means of access to the crew's quarters have not been maintained in as effective a condition as they were when the Certificate was issued.

3. When this Certificate has expired or been canceled, it must be delivered to the Assigning Authority.

APPLIANCES FOR CLOSING ACCESS OPENINGS IN BULKHEADS AT ENDS OF DETACHED SUPERSTRUCTURES

Forecastle _____

Bridge, fore end _____

Bridge, after end _____

Poop _____

TEMPORARY APPLIANCES FOR CLOSING OPENINGS IN SUPERSTRUCTURE DECKS

_____

_____

**At the expiration of the certificate, renewal should be obtained in accordance with the Load Line Regulations and if upon examination the ship is found to be in a satisfactory condition, this certificate will be extended and so endorsed on the reverse side.

COASTWISE LOAD LINE CERTIFICATE

[Form C1]

Issued under the authority of the United States of America, Commandant, U. S. Coast Guard, under the provisions of the Coastwise Load Line Act, 1935, as amended.

[SEAL]

Issued by _____

Certificate No. _____

Name of ship _____

Port of registry _____ Official No. _____

Gross tonnage _____

| FREEBOARD FROM DECK LINE | LOAD LINE | |
|---|---|---|
| Tropical _____ | (T) _____ | Above (S) |
| Summer _____ | (S) Upper edge of line through center of disk. | |
| Winter _____ | (W) _____ | Below (S) |

*Allowance for fresh water for all freeboards _____

(All measurements are to upper edges of the respective horizontal lines.)

The upper edge of the deck line from which these freeboards are measured is _____ inches above the top of the _____ deck at side.

This is to certify that this ship has been surveyed and the freeboards and load lines shown above have been assigned in accordance with the Commandant, U. S. Coast Guard, Coastwise Load Line Regulations.

**This certificate remains in force until _____

Issued at _____ on the _____ day of _____, 19__.

(Here follows the signature or seal and description of the assigning authority.)

NOTES: (1) In accordance with the Load Line Regulations, the disk and lines must be permanently marked by center punch marks or cutting. Letters indicating the assigning authority are to be marked alongside the disk and above the center line. Periodic inspections are to be made at intervals of approximately twelve months.

(2) The load line assignment given by this certificate necessarily assumes that the nature and stowage of cargo, ballast, etc., are such as to secure sufficient stability for the vessel. Accordingly, it is the owner's responsibility to furnish the Master of the vessel with stability information and instructions when this is necessary to maintenance of sufficient stability.

(On the reverse side of the load line certificate, or on a separate sheet attached and forming part of the certificate, provision is to be made for annual inspection and renewal endorsements.)

*Where seagoing steamers navigate a river or inland water, deeper loading is permitted corresponding to the weight of fuel, etc., required for consumption between the point of departure and the open sea.

**At the expiration of the certificate, renewal should be obtained in accordance with the Load Line Regulations and if upon examination the ship is found to be in a satisfactory condition, this certificate will be extended and so endorsed on the reverse side.

(Reverse side of certificate)

ANNUAL INSPECTION

I have surveyed this ship for the purpose of seeing whether this certificate should remain in force and the survey has been completed to my satisfaction.

_____ _____ _____

(Signature of Surveyor) (Place) (Date)

I have surveyed this ship for the purpose of seeing whether this certificate should remain in force and the survey has been completed to my satisfaction.

_____ _____ _____

(Signature of Surveyor) (Place) (Date)

I have surveyed this ship for the purpose of seeing whether this certificate should remain in force and the survey has been completed to my satisfaction.

_____ _____ _____

(Signature of Surveyor) (Place) (Date)

I have surveyed this ship for the purpose of seeing whether this certificate should remain in force and the survey has been completed to my satisfaction.

_____ _____ _____

(Signature of Surveyor) (Place) (Date)

RENEWAL OF LOAD LINE CERTIFICATE

The provisions of the Coastwise Load Line Regulations of the Commandant, U. S. Coast Guard, being fully complied with by this ship, this certificate is renewed until _____, 19__.

Place _____

Date _____

Assigning Authority

By _____

(Surveyor)

NOTES

1. The periods and areas during which the seasonal load lines apply are as stated in the Load Line Regulations.

2. This Load Line Certificate will be canceled by the Commandant, U. S. Coast Guard, if—

(a) The periodic inspections have not been carried out.

(b) Material alterations have been made to the hull or superstructures which would affect the calculations determining the position of the load lines.

(c) The fittings and appliances for the protection of the openings, guard rails, freeing ports, or the means of access to the crew's quarters have not been maintained in as effective a condition as they were when the Certificate was issued.

3. When this certificate has expired or been canceled, it must be delivered to the Assigning Authority.

APPLIANCES FOR CLOSING ACCESS OPENINGS IN BULKHEADS AT ENDS OF DETACHED SUPERSTRUCTURES

Forecastle _____

Bridge, fore end _____

Bridge, after end _____

Poop _____

TEMPORARY APPLIANCES FOR CLOSING OPENINGS IN SUPERSTRUCTURE DECKS

_____

_____



COASTWISE LOAD LINE CERTIFICATE

COASTWISE LOAD LINE CERTIFICATE
[Form C2]

Issued under the authority of the United States of America, Commandant, U. S. Coast Guard, under the provisions of the Coastwise Load Line Act, 1935, as amended.

[SEAL]
Issued by _____
Certificate No. _____
Name of ship _____ Official No. _____
Port of registry _____ Gross tonnage _____

| FREEBOARD FROM DECK LINE | LOAD LINE |
|---|---|
| Tropical / Summer / Winter _____ | Upper edge of line through center of disk. |

Allowance for fresh water for all freeboards _____

(All measurements are to upper edges of the respective horizontal lines.)

The upper edge of the deck line from which these freeboards are measured is _____ inches above the top of the _____ deck at side.

This is to certify that this ship has been surveyed and the freeboards and load lines shown above have been assigned in accordance with the Commandant, U. S. Coast Guard, Coastwise Load Line Regulations.

*This certificate remains in force until _____
Issued at _____ on the _____ day of _____, 19__.

(Here follows the signature or seal and description of the assigning authority.)

NOTES: (1) In accordance with the Load Line Regulations, the disk and lines must be permanently marked by center punch marks or cutting. Letters indicating the assigning authority are to be marked alongside the disk and above the centerline. Periodic inspections are to be made at intervals of approximately twelve months.

(2) The load line assignment given by this certificate necessarily assumes that the nature and stowage of cargo, ballast, etc., are such as to secure sufficient stability for the vessel. Accordingly, it is the owner's responsibility to furnish the Master of the vessel with stability information and instructions when this is necessary to maintenance of sufficient stability.

(On the reverse side of the load line certificate, or on a separate sheet attached and forming part of the certificate, provision is to be made for annual inspection and renewal endorsements.)

(Reverse side of certificate to be prepared with notes and for endorsements as set forth for Form C1.)

*At the expiration of this certificate, renewal should be obtained in accordance with the Load Line Regulations and if upon examination the ship is found to be in a satisfactory condition, this certificate will be extended and so indorsed on the reverse side.

COASTWISE LOAD LINE CERTIFICATE
[Form C3]

Issued under the authority of the United States of America, Commandant, U. S. Coast Guard, under the provisions of the Coastwise Load Line Act, 1935, as amended.

[SEAL]
Issued by _____
Certificate No. _____
Name of ship _____ Official No. _____
Port of registry _____ Gross tonnage _____

| FREEBOARD FROM DECK LINE | | LOAD LINE |
|---|---|---|
| Tropical | (T) | Above (S) |
| Summer | (S) | Upper edge of line through center of disk. |
| Winter | (W) | Below (S) |

*Allowance for fresh water for all freeboards _____

The timber freeboards given in this certificate are applicable only when this ship carries a timber deck cargo and complies with the special requirements of the Load Line Regulations regarding timber deck cargoes.

| FREEBOARDS FROM DECK LINE | | LOAD LINE |
|---|---|---|
| Tropical (Timber) | (LT) | Above (S) |
| Summer (Timber) | (LS) | Above (S) |
| | | Above (S) |
| Winter (Timber) | (LW) | Below (S) |

(All measurements are to upper edges of the respective horizontal lines.)

The upper edge of the deck line from which these freeboards are measured is _____ inches above the top of the _____ deck at side.

This is to certify that this ship has been surveyed and the freeboards and load lines shown above have been assigned in accordance with the Commandant, U. S. Coast Guard, Coastwise Load Line Regulations.

**This certificate remains in force until _____
Issued at _____ on the _____ day of _____, 19__.

(Here follows the signature or seal and description of the assigning authority.)

NOTES: (1) In accordance with the Load Line Regulations, the disk and lines must be permanently marked by center punch marks or cutting. (The diagram showing the timber load line marks is to be inserted above by the assigning authority.) Letters indicating the assigning authority are to be marked alongside the disk and above the centerline. Periodic inspections are to be made at intervals of approximately twelve months.

*Where seagoing steamers navigate a river or inland water, deeper loading is permitted corresponding to the weight of fuel, etc., required for consumption between the point of departure and the open sea.

**At the expiration of this certificate, renewal should be obtained in accordance with the Load Line Regulations and if upon examination the ship is found to be in a satisfactory condition, this certificate will be extended and so endorsed on the reverse side.

(2) The load line assignment given by this certificate necessarily assumes that the nature and stowage of cargo, ballast, etc., are such as to secure sufficient stability for the vessel. Accordingly, it is the owner's responsibility to furnish the Master of the vessel with stability information and instructions when this is necessary to maintenance of sufficient stability.

(On the reverse side of the load line certificate, or on a separate sheet attached and forming part of the certificate, provision is to be made for annual inspection and renewal endorsements.)

(Reverse side of certificate to be prepared with notes and for endorsements as set forth for Form C1.)

COASTWISE LOAD LINE CERTIFICATE

[Form C4; applicable to vessels assigned freeboards on the basis of 46 CFR 43.15–87, 43.15–90, 43.15–98, and/or 43.30–75]

Issued under authority of the United States of America, Commandant, U.S. Coast Guard, under the provisions of the Coastwise Load Line Act, 1935, as amended.

This Certificate is valid only for vessels on United States' coastwise and/or intercoastal voyages.

[SEAL]

Issued by _____

Certificate No. _____

Name of ship _____ Official No. _____

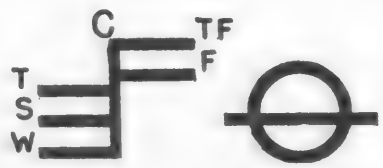
Port of registry _____ Gross tonnage _____

| FREEBOARD FROM DECK LINE | | LOAD LINE |
|---|---|---|
| Tropical _____ | (T) | Above upper edge of line through center of disk. |
| Summer _____ | (S) | Above upper edge of line through center of disk. |
| Winter _____ | (W) | Below upper edge of line through center of disk. |

*Allowance for fresh water for all freeboards _____

(All measurements are to upper edges of the respective horizontal lines.)

The upper edge of the deck line from which these freeboards are measured is _____ inches above the top of the _____ deck at side.




This is to certify that this ship has been surveyed and the freeboards and load lines shown above have been assigned in accordance with the Commandant, U.S. Coast Guard, Coastwise Load Line Regulations.

**This certificate remains in force until _____

Issued at _____ on the _____ day of _____, 19__.

(Here follows the signature or seal and description of the assigning authority.)

NOTES: (1) In accordance with the Load Line Regulations, the disk and lines must be permanently marked by center punch marks or cutting. Letters indicating the assigning authority are to be marked alongside the disk and above the centerline. Periodic inspections are to be made at intervals of approximately twelve months.

(2) The load line assignment given by this certificate necessarily assumes that the nature and stowage of cargo, ballast, etc., are such as to secure sufficient stability for the vessel. Accordingly, it is the owner's responsibility to furnish the Master of the vessel with stability information and instructions when this is necessary to maintenance of sufficient stability.

(On the reverse side of the load line certificate, or on a separate sheet attached and forming part of the certificate, provision is to be made for annual inspection and renewal endorsements.)

(Reverse side of certificate to be prepared with notes and for endorsements as set forth for Form C1.)

*Where seagoing steamers navigate a river or inland waters, deeper loading is permitted corresponding to the weight of fuel, etc., required for consumption between the point of departure and the open sea.

**At the expiration of the certificate, renewal should be obtained in accordance with the Load Line Regulations, and if upon examination the ship is found to be in satisfactory condition, this certificate will be extended and so endorsed on the reverse side.

### § 43.40–15 Titles of load line laws and rules regarded as equivalent to the British Board of Trade Rules, 1906.

(a) *Australia.* Part IV of the Navigation Act, 1912–1920, and Navigation (Load Line) Regulations of the 17th December 1924.

(b) *Belgium.* Loi sur la sécurité des navires (7 décembre 1920).

(c) *Chile.* Reglamento para el trazato del disco marcas y linea oficial de carguio de las naves mercantes (Decree No. 1892 of the 12th November 1919).

(d) *Denmark.* Merchant Shipping (inspection of ships) Act of the 29th March 1920, with later amendments.

Rule and Tables of Freeboard for Ships, dated the 30th September 1909, as amended by notification of the 25th July 1918.

(e) *France.* Loi du 17 avril 1907, arrêté du 5 septembre 1908. Décret du 21 septembre 1908. Autre décret du 21 septembre 1908, modifié par le décret du 1 septembre 1925. Décret du 12 mai 1927. Décret du 17 janvier 1928.

(f) *Germany.* Vorschriften der See-Berufsgenossenschaft über den Freibord für Dampfer und Segelschiffe, Ausgabe 1908.

(g) *Hong Kong.* Merchant shipping consolidation ordinance (No. 10 of 1899), as amended by ordinances Nos. 31 of 1901, 2 of 1903, 5 of 1905, 16 of 1906, 9 of 1909, and 6 of 1910.

(h) *Iceland.* Law No. 58 of the 14th June, 1929, sections 25–26.

(i) *India.* Indian Merchant Shipping Act, 1923.

(j) *Italy.* Regole e tavole per assignazione del "Bordo Libero", approved by decree dated the 1st February 1929—VII of the Italian Minister for Communications.

Prior to 1929—British Board of Trade Rules, 1906.

(k) *Japan.* Ship load line law [Law No. 2 of the 10th year of Taisho (1921)] and the rules and regulations relating thereto.

(l) *Netherlands.* Decree of the 22d September 1909 (Official Journal No. 315).

(m) *Netherland Indies.* Netherlands decree of the 22d September 1909 (Official Journal No. 315).

(n) *New Zealand.* British Board of Trade Rules, 1906.

(o) *Norway.* Norwegian Freeboard Rules and Tables of 1909.

(p) *Portugal.* Decree No. 11,210 of the 18th July 1925, and regulations and instructions relating thereto.

(q) *Spain.* Reglamento para el Trazado del Disco y Marcas de Maxima Carga de los buques marchantes, 1914.

(r) *Straits Settlements.* British Board of Trade Rules, 1906.

(s) *Sweden.* Rules and Tables of Freeboard approved by decree of the 21st May 1910.

(t) *United Kingdom.* Board of Trade Rules, 1906.

(u) *Union of Soviet Socialist Republics.* Rules and Regulations relating to the Load Lines of Seagoing Merchant Vessels, published by Register of the Union of Soviet Socialist Republics, 1928.

# PART 44—VARIANCE FOR STEAM COLLIERS, BARGES, AND SELF-PROPELLED BARGES (WHEN ENGAGED IN SPECIAL SERVICES ON COASTWISE AND INTER-ISLAND VOYAGES)

Subpart 44.01—Administration

Sec.
44.01–1 Establishment of load lines for special services.
44.01–5 Administration; special service.
44.01–10 Approval by Commandant, U. S. Coast Guard, of special service.
44.01–11 Assignment and marking load lines; special service.
44.01–12 Voyage limits; special service.
44.01–15 Special service certificate.
44.01–20 New and existing vessels; special service.

Subpart 44.05—Rules of Assignment; Special Service

44.05–1 General.
44.05–5 Definitions.
44.05–10 Load line markings.
44.05–15 Existing vessels.
44.05–20 Conditions of assignment.
44.05–25 Freeboards.
44.05–30 Load line certificate.
44.05–35 Form of load line certificate.

AUTHORITY: The provisions of this Part 44 issued under sec. 2, 49 Stat. 888, as amended; 46 U.S.C. 88a. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–48, October 19, 1962, 27 F.R. 10504.

## Subpart 44.01—Administration

### § 44.01–1 Establishment of load lines for special services.

(a) Load lines are established for steam colliers, tugs, barges, and self-propelled barges engaged in special services in conformity with the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88i).

(b) Load lines for steam colliers, barges, and self-propelled barges engaged on specially limited coastwise voyages as described in § 44.01–12 shall be established pursuant to the regulations in this part.

(c) Variance for tugs is not permitted.

### § 44.01–5 Administration; special service.

(a) The administrative provisions of §§ 43.01–1—43.01–100 of this subchapter, relating to vessels engaged in foreign and coastwise voyages, where applicable, shall apply to vessels subject to this part except as modified in paragraph (b) of this section.

(b) Application for the assignment of load lines under this part for the types of vessels described in § 44.01–1 shall be made in writing to the American Bureau of Shipping unless another society has been specifically approved by the Commandant as a load line assigning authority. In the latter case application shall be made to the society so approved. Applications shall state the following information:

(1) Name of vessel and official number.

(2) Type of vessel (steam collier, barge, or self-propelled barge).

(3) Date keel was laid.

(4) Normal sea speed of vessel.

(5) Limits of voyage for which approval is requested.

(6) Normal maximum distance offshore in course of voyage.

(7) Length of voyage in days and nautical miles.

(8) Statement of weather conditions to be expected.

(9) Cargo to be carried.

(10) Whether vessel is to be operated manned or unmanned.

### § 44.01–10 Approval by Commandant, U.S. Coast Guard, of special service.

(a) Subject to the conditions contained in this part, the Commandant, U.S. Coast Guard, has determined that load lines at variance from the position fixed by the International Load Line Treaty, 1930, but not above the actual line of safety, may be assigned steam colliers, barges, or self-propelled barges (separately by class) for certain specifically limited coastwise voyages between ports of the continental United States or between islands of a group over which the United States has jurisdiction.

### § 44.01–11 Assignment and marking load lines; special service.

(a) The assignment and marking of special service load lines and certifications thereof shall be in accordance with this part to the satisfaction of the American Bureau of Shipping. The load line certificate shall define the voyage limits and seasonal restrictions governing the validity of the load lines.

### § 44.01–12 Voyage limits; special service.

(a) Special service load lines may be assigned for operation not more than a specified limited distance offshore which shall not exceed 20 nautical miles. The offshore distance shall be measured from the coastline except where a line of inland waters has been otherwise established.

(b) For continental United States ports, special service load lines may be issued for operation between but not to exceed the extreme port limits specified below, or for operation between intermediate ports within the extreme limits specified:

(1) Central and Northern Atlantic Coast—From Norfolk, Virginia, to Eastport, Maine.

(2) Southeast Atlantic Coast—From Key West, Florida, to Jacksonville, Florida, except that the special service load line shall not be valid for manned vessels during the hurricane season, i.e., July 1st to November 15th, both dates inclusive.

(3) Gulf of Mexico Coast—From the mouth of the Rio Grande River, Texas, to Key West, Florida, except that the special service load line shall not be valid for manned vessels during the hurricane season, i.e., July 1st to November 15th, both dates inclusive.

(4) Pacific Coast—From San Francisco, California, to San Diego, California.

(c) Assignment of special service load lines for voyage limits between the islands of a group over which the United States has jurisdiction shall be made only upon authorization by the Commandant, U.S. Coast Guard, after submittal to him of the information called for by § 44.01–5 (b).

### § 44.01–15 Special service certificate.

(a) The use of the special service load line certificate issued under this part is limited to voyages only as described in the certificate. If the vessel engages on any voyage not contemplated by the certificate where a load line is required, the load line prescribed by Part 43 of this subchapter shall govern.

(b) Vessels engaged on special services in the coastwise trade and the inter-island trade will be certificated on the form shown in § 44.05–35.

### § 44.01–20 New and existing vessels; special service.

(a) A new vessel marked with load lines for special service on a coastwise or inter-island voyage is a vessel whose keel was laid on or after September 28, 1937. An existing vessel is one whose keel was laid before that date.

## Subpart 44.05—Rules of Assignment; Special Service

### § 44.05–1 General.

(a) The load line regulations in this part are complementary to those in Part 43 or Part 45 (Great Lakes load line regulations) of this subchapter, as reference is made thereto.

### § 44.05–5 Definitions.

(a) A steam collier is a vessel mechanically propelled, and specially designed for the carriage of coal in bulk.

(b) A towed barge is a vessel without sufficient means for self-propulsion and which requires to be towed.

(c) A self-propelled barge is a vessel mechanically propelled of the type specially designed for use in limited coastwise and Great Lakes service and capable of transiting interconnecting canals.

### § 44.05–10 Load line markings.

(a) The load line marks on the vessel's sides are to be in accordance with § 43.05–15 of this subchapter, figure 43.05–5(a). Seasonal markings such as "Winter North Atlantic" which are not applicable to the voyage will be omitted.

(b) In the case of vessels which engage in special services on coastwise voyages and voyages on the Great Lakes, the marks on the vessel's sides are to be in accordance with Figure 44.05–10(b), except that the lines marked "SW" and "MS" shall be used only where applicable.

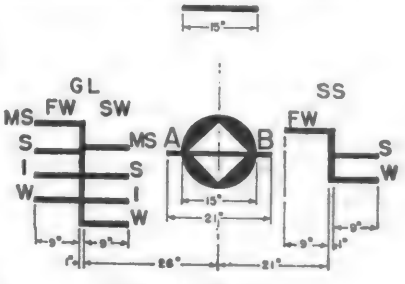



FIGURE 44.05–10(b).

(c) The load lines aft of the combined disk and diamond will be applicable for voyages on the Great Lakes and those on the forward side will be applicable to limited coastwise voyages. The summer line on the ocean will correspond to the summer line on the Lakes and the winter line on the ocean will correspond to the intermediate line on the Lakes.

(d) In the case of vessels which operate both on special service coastwise voyages and on unlimited coastwise voyages, the marks on the ship's sides are to be in accordance with figure 44.05–10 (d). The load lines aft of the disk will be applicable to voyages in special service coastwise or inter-island voyages and those on the forward side will be applicable to unlimited coastwise voyages. (A vessel marked for both special service and unlimited coastwise voyages and furnished with a load line certificate on the international form shall, when entering the foreign trade, arrange that the load line markings are in accord with the vessel's international load line certificate by the elimination of the marks aft of the disk.)

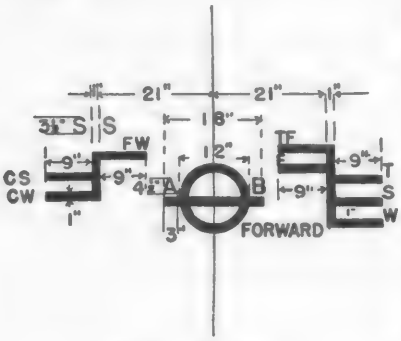



FIGURE 44.05–10 (d).

### § 44.05–15 Existing vessels.

(a) In assigning load lines to an existing vessel the provisions of the regulations in this part shall be complied with in principle and detail insofar as is reasonable and practicable, having regard to the proven efficacy of existing arrangements for a special service voyage, and having particular regard to the provision of sufficient means for the protection and safety of the crew.

(b) Where it is neither reasonable nor practicable to comply with this part in its entirety, the assigning authority will, in each case, report to the Commandant, U. S. Coast Guard, the specific matters in which the vessel is deficient with such recommendations as may seem desirable. Upon the receipt of this report the Commandant, U. S. Coast Guard, shall determine such addition to the freeboard as will, in the judgment of the Commandant, U. S. Coast Guard, make the vessel as safe as if it had fully complied with this part.

### § 44.05–20 Conditions of assignment.

(a) *Steam colliers.* The conditions of assignment for steam colliers shall be in accordance with the requirements of Part 43 of this subchapter and also with the supplementary requirements of §§ 43.30–1 to 43.30–70 of this subchapter in cases where a tanker freeboard is assigned, except that in the case of steam colliers constructed with bulwarks, the freeing port may be of a practically continuous slot type, located as low as possible, the clear area of the slot to be not less than 20 percent of the superficial area of the unpierced bulwarks. If, due to sheer, or other conditions, the assigning authority considers that extra local provision should be made for freeing decks of water, the slots are to be located so as to have maximum efficacy.

(b) *Towed barges.* The conditions of assignment for towed cargo barges where the cargo is carried under deck shall be in accordance with §§ 45.10–5 to 45.10–100 of this subchapter. In the case of tank barges and cargo barges carrying cargo only on deck, compliance will also be required with the supplementary conditions of §§ 45.20–1 to 45.20–70 of this subchapter. In the case of cargo barges of the open type, assignment will be limited to barges in unmanned operation and the construction of the vessel must be such as to satisfy the assigning authority that no unusual hazards will be experienced.

(c) *Self-propelled barges.* The conditions of assignment for self-propelled cargo barges carrying cargo under decks shall be in accordance with the provisions of §§ 45.10–5 to 45.10–100 of this subchapter. In the case of self-propelled tank barges and self-propelled cargo barges carrying cargo only on deck, compliance will also be required with the supplementary conditions of §§ 45.20–1 to 45.20–70 of this subchapter.

### § 44.05–25 Freeboards.

(a) *General.* (1) When the assigning authority is satisfied that the requirements of this part as applicable to the type of vessel under consideration are complied with the freeboards will be computed as described in this section.

(2) In the assignment of freeboards under this part, the provisions of § 43.01–32 relating to stability are applicable.

(b) *Steam colliers.* Steam colliers that have constructional features similar to those of a tanker which afford extra invulnerability against the sea may be assigned a reduction of freeboard from that determined under §§ 43.15–1 to 43.15–97 of this subchapter. The amount of such reduction shall be determined by the assigning authority, in relation to the freeboard assigned to tankers, having regard to the degree of compliance with the supplementary conditions of assignment laid down for these ships, but without regard to the degree of subdivision provided. The freeboard assigned to such a vessel shall in no case be less than would be assigned the vessel as a tanker, as determined by §§ 43.30–1 to 43.30–70 of this subchapter.

(c) *Towed cargo barges with cargo under deck.* The freeboard is to be computed under §§ 45.15–1 to 45.15–97 of this subchapter. The fresh water and seasonal markings where applicable are to be determined from §§ 43.15–1 to 43.15–97 of this subchapter.

(d) *Towed cargo barges with cargo only on deck.* The freeboard for barges of this type is to be computed in accordance with the requirements of §§ 45.20–1 to 45.20–70 of this subchapter. The fresh water and seasonal markings where applicable are to be the same as determined from §§ 43.15–1 to 43.15–97 of this subchapter.

(e) *Towed cargo barges of the open type.* The load line shall be placed where, in the judgment of the assigning authority, the draft will be such that no unusual hazard will be experienced. In general, drafts assigned will be such that the barge will remain afloat with a reasonable freeboard after flooding of the net available open space.

(f) *Towed tank barges.* The freeboard is to be computed in accordance with §§ 45.20–1 to 45.20–70 of this subchapter. The fresh water and seasonal markings where applicable are to be determined from §§ 43.15–1 to 43.15–97 of this subchapter.

(g) *Self-propelled cargo barges.* The freeboard is to be computed under §§ 45.15–1 to 45.20–15 of this subchapter. The fresh water and seasonal markings where applicable are to be determined from §§ 43.15–1 to 43.15–97 of this subchapter.

(h) *Self-propelled tank barges.* The freeboard is to be computed in accordance with §§ 45.20–1 to 45.20–70 of this subchapter. The fresh water and seasonal markings where applicable are to be determined from §§ 43.15–1 to 43.15–97 of this subchapter.

### § 44.05–30 Load line certificate.

(a) The load line certificates for a special service coastwise or special inter-island voyage shall be issued in addition to any other applicable load line certificates and shall be on the form shown in § 44.05–35.

### § 44.05–35 Form of load line certificate.

(a) Where no other Load Line certificate is issued:

LOAD LINE CERTIFICATE FOR A SPECIAL SERVICE COASTWISE OR INTER-ISLAND VOYAGE

Issued under the authority of the Commandant, U. S. Coast Guard, United States of America, under the provisions of the Coastwise Load Line Act of August 27, 1935, as amended.

[SEAL]

Issued by_____

Certificate No._____

This certificate is valid only for coastwise or inter-island voyages that are between the limits of_____ and_____ provided the vessel is engaged solely in the trade stated herein.

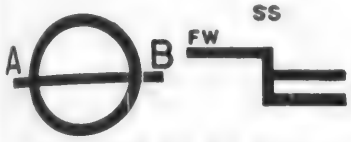
Ship_____ Official No._____

Port of registry_____ Trade of vessel_____

Gross tonnage_____

| FREEBOARD FROM DECK LINE | | LOAD LINE |
|---|---|---|
| Tropical_____ | (T) | _____Above (S) |
| Summer_____ | (S) | __Upper edge of line through center of disk. |
| Winter_____ | (W) | _____Below (S) |

*Allowance for fresh water for all freeboards (except on the Great Lakes)_____
The upper edge of the deck line from which these freeboards are measured is_____ inches above the top of the____deck at side.




This is to certify that this ship has been surveyed and the freeboards and load lines shown above have been found to be correctly marked upon the vessel in manner and location as provided by the Load Line Regulations of the Commandant, U.S. Coast Guard, applicable to vessels engaged on this special service voyage.

**This certificate remains in force until _____ Issued at _____ on the _____ day of _____, 19_____.

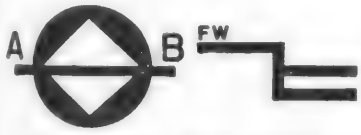
(Here follows the signature or seal and description of the assigning authority)

NOTES: (1) In accordance with the Load Line Regulations, the disk or diamond and the lines must be permanently marked by center punch marks or cutting.

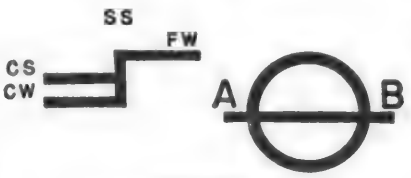
(2) The load line assignment given by this certificate necessarily assumes that the nature and stowage of cargo, ballast, etc., are such as to secure sufficient stability for the vessel. Accordingly, it is the owner's responsibility to furnish the Master of the vessel with stability information and instructions when this is necessary to maintenance of sufficient stability.

(On the reverse side of the load line certificate, the provision for annual inspection endorsement and for renewal of the certificate is to be the same as for vessels engaged in the foreign trade.)

(b) Where the Special Service Load Line Certificate is issued in addition to a Great Lakes Load Line Certificate, the wording of the Special Service Load Line Certificate is to be identical to that given in paragraph (a) of this section, but the markings indicated in the form shall be replaced by the following markings:




(c) Where the Special Service Load Line Certificate is issued in addition to an Unlimited Coastwise or International Load Line Certificate, the wording of the Special Service Load Line Certificate is to be identical to that given in paragraph (a) of this section, but the markings indicated in the form shall be replaced by the following markings:




*Where seagoing steamers navigate a river or inland water, deeper loading is permitted corresponding to the weight of fuel, etc., required for consumption between the point of departure and the open sea.

**Upon the expiration of the certificate renewal must be obtained as provided by the Load Line Regulations and the certificate so endorsed. Endorsement should also be made in the spaces provided on the occasion of each annual inspection required by the Load Line Regulations.

## PART 45—MERCHANT VESSELS WHEN ENGAGED IN A VOYAGE ON THE GREAT LAKES

### Subpart 45.01—Administration

Sec.
45.01–1 Establishment of Great Lakes load lines.
45.01–5 Responsibility for administration.
45.01–10 Application of regulations.
45.01–13 Penalties for load line violations.
45.01–15 Tankers.
45.01–17 Cargo vessels.
45.01–20 Vessels of special design.
45.01–22 Stability.
45.01–25 Marks to indicate maximum load lines.
45.01–30 Assignment and certification of load lines; assigning authority.
45.01–35 Survey for the assignment of new load line and renewal of load line certificate.
45.01–40 Annual load line inspection.
45.01–45 Application for assignment, renewal, and certification of load line marks.
45.01–50 Application for annual load line inspections.
45.01–55 Equivalents.
45.01–60 Validity of certificates; renewal of certificates.
45.01–65 Form of certificate.
45.01–70 Cancellation of load line certificate.
45.01–75 Seasonal load lines.
45.01–80 Logbook entries.
45.01–85 Control.
45.01–90 Approval of the Commandant.

### Subpart 45.05—General Rules for Determining Maximum Load Lines of Merchant Vessels on the Great Lakes

45.05–1 Definitions.
45.05–5 Deck line.
45.05–10 Load line diamond.
45.05–15 Lines to be used in connection with the diamond.
45.05–20 Mark of assigning authority.
45.05–25 Details of marking.
45.05–30 Verification of marks.

### Subpart 45.10—Conditions of Assignment of Load Lines

45.10–1 Construction of vessel.
45.10–5 Cargo and other hatchways not protected by superstructures.
45.10–10 Hatchway coamings.
45.10–15 Hatchway covers.
45.10–20 Hatchway beams.
45.10–25 Carriers or sockets.
45.10–30 Cleats and fasteners.
45.10–35 Battens and wedges.
45.10–40 Tarpaulins.
45.10–45 Security of hatchway covers.
45.10–50 Cargo and other hatchways in the freeboard deck within superstructures which are fitted with closing appliances less efficient than class 1.
45.10–55 Hatchway coamings and closing arrangements.
45.10–57 Machinery space openings in exposed positions on freeboard and raised quarter-decks.
45.10–60 Machinery space openings in exposed positions on superstructure decks other than raised quarter-decks.
45.10–65 Machinery space openings in the freeboard deck within superstructures which are fitted with closing appliances less efficient than class 1.
45.10–67 Flush scuttles.
45.10–70 Companionways.
45.10–75 Ventilators in exposed positions on freeboard and superstructure decks.
45.10–77 Air pipes.
45.10–80 Gangway, cargo, and coaling ports, etc.
45.10–85 Scuppers and sanitary discharge pipes.
45.10–87 Air ports.
45.10–90 Guardrails.
45.10–95 Freeing ports.
45.10–100 Protection of crew.

### Subpart 45.15—Load Lines for Steamers

45.15–1 Length (L).
45.15–5 Breadth (B).
45.15–7 Molded depth.
45.15–10 Depth for freeboard (D).
45.15–15 Coefficient of fineness (c).
45.15–17 Strength.
45.15–20 Height of superstructure.
45.15–25 Standard height of superstructure.
45.15–27 Length of superstructure (S).
45.15–30 Inclosed superstructure.
45.15–35 Superstructure bulkheads.
45.15–37 Class 1 closing appliances.
45.15–40 Class 2 closing appliances.
45.15–45 Temporary closing appliances.
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### Subpart 45.20—Load Lines for Tankers

45.20–1 Definition.
45.20–5 Marks on sides.
45.20–10 Construction.
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Sec.
45.20–40 Ventilators.
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45.20–70 Freeboard table for tankers.

Subpart 45.25—Fees and Form of Certificate

45.25–1 Fees.
45.25–5 Form of load line certificate.

AUTHORITY: The provisions of this Part 45 issued under sec. 2, 49 Stat. 888, as amended; 46 U.S.C. 88a. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–48, October 19, 1962, 27 F.R. 10504, unless otherwise noted.

## Subpart 45.01—Administration

### § 45.01–1 Establishment of Great Lakes load lines.

(a) Load lines are established for merchant vessels of 150 gross tons or over when engaged on Great Lakes voyages in conformity with the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88i).

(b) Load lines for merchant vessels of 150 gross tons or over when engaged on Great Lakes voyages shall be pursuant to the regulations in this part.

(c) The load line regulations for merchant vessels when engaged in foreign voyages (the Great Lakes excepted) or coastwise voyages are in Part 43 of this subchapter. The load line regulations applicable to coastwise load lines for steam colliers, barges, and self-propelled barges in specially limited coastwise voyages are in Part 44 of this subchapter.

(d) In concurrence with related Canadian regulations, the waters of the St. Lawrence River west of a straight line drawn from Cap de Rosiers to West Point Anticosti Island, and west of a line along 63° W. longitude from Anticosti Island to the north shore of the St. Lawrence River shall be considered as a part of the Great Lakes.

### § 45.01–5 Responsibility for administration.

(a) Under the general direction and supervision of the Secretary of the Treasury, the Commandant of the United States Coast Guard is delegated the responsibility and authority for the administration of the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88i).

### § 45.01–10 Application of regulations.

(a) No merchant vessel of the United States of 150 gross tons or over shall proceed on a voyage on the Great Lakes, or arrive from a voyage on the Great Lakes, or operate on the Great Lakes, and no foreign merchant vessel of 150 gross tons or over shall arrive from a voyage on the Great Lakes or shall proceed on a voyage on the Great Lakes, when within the jurisdiction of the United States, unless such vessel is:

(1) Marked with load lines under the load line regulations in Part 43 of this subchapter and has on board a valid load line certificate, or

(2) A foreign vessel exempted under section 5 of the Coastwise Load Line Act, 1935, or is marked and certificated as to load lines under the provisions of and in accordance with the International Load Line Convention 1930 and has on board a valid load line certificate, or

(3) A new vessel:

(i) Has been surveyed in accordance with the provisions of this part.

(ii) Complies with the provisions of this part as applicable to the type of vessel dealt with.

(iii) Has been marked in accordance with the provisions of this part.

(iv) Has had the marks certified as correct as provided by this part.

(A new vessel is one whose keel was laid on or after August 27, 1935.)

(4) An existing vessel:

(i) Has been surveyed, marked, and the marks certified either under the provisions of the regulations in this part as applicable to the type of vessel, or

(ii) Complies as defined for the type of vessel with the provisions of this part in principle and detail so far as is reasonable and practicable, having regard to the efficacy of the protection of openings, guard rails, freeing ports, and means of access to crews quarters, provided by the existing arrangements, fittings, and appliances of the vessel.

(b) Where it is neither reasonable nor practicable to comply with this part in its entirety, the assigning authority will, in each case, report to the Commandant, U. S. Coast Guard, the specific matters in which the vessel is deficient with such recommendations as seem desirable. Upon the receipt of this report the Commandant, U. S. Coast Guard, shall determine such addition to the freeboard as will, in the judgment of the Commandant, U. S. Coast Guard, make the vessel as safe as if it had fully complied with this part.

### § 45.01–13 Penalties for load line violations.

(a) For violations of the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88i), and the regulations in this subchapter, which apply to merchant vessels engaged in voyages on the Great Lakes, see § 43.01–13 of this subchapter for a description of the applicable penalties and procedures.

### § 45.01–15 Tankers.

(a) A steamer specially constructed for the carriage of liquid cargoes in bulk which has been surveyed as provided by § 45.01–10 shall be marked with tanker load lines and the marks certified as correct, if being:

(1) A new vessel, it complies with the conditions and provisions prescribed in §§ 45.20–10—45.20–70.

(2) An existing vessel, it complies with the conditions and provisions in §§ 45.20–10, 45.20–25—45.20–40 and, also, in principle so far as is reasonable and practicable, with §§ 45.20–15, 45.20–20, 45.20–45: *Provided*, That in assigning a tanker load line to an existing vessel such additions to the freeboard shall be made as is reasonable having regard to the extent to which the vessel falls short of full compliance with the conditions and provisions prescribed in §§ 45.20–15, 45.20–20, 45.20–45.

(b) For the purpose of the application of §§ 45.01–75, 45.05–15 and 45.15–94 there are included non-propelled tank barges of shipshape form specially constructed for the carriage of liquid cargoes in bulk.

### § 45.01–17 Cargo vessels.

For the purpose of §§ 45.01–75, 45.05–15 and 45.15–94 a cargo vessel is defined as a vessel either self-propelled or non-propelled of shipshape form constructed for the carriage of dry cargoes, and which is regularly engaged in the transportation thereof.

### § 45.01–20 Vessels of special design.

(a) Sand suckers and other vessels of special design that cannot be assigned load lines by direct application of the rules set forth in this subchapter, will be assigned load lines based on the individual consideration of each vessel. Before such vessels are marked and certified, the assigning authority shall obtain the approval of the Commandant, U. S. Coast Guard, as to the position of the load line marks.

(b) In the location of load lines on sand suckers and similar vessels, consideration will be given to the effect of flooding of open cargo spaces, and the draft permitted will not be in excess of that which, in the judgment of the assigning authority, with the approval of the Commandant, U. S. Coast Guard, provides a reasonable margin of safety under such circumstances.

(c) Open hopper type barges will be limited to unmanned operation over restricted routes.

### § 45.01–22 Stability.

(a) The rules of this part necessarily assume that the nature and stowage of the cargo, ballast, etc., are such as to secure sufficient stability for the vessel.

(b) Having regard for the fact that certain vessels, such as those carrying all their cargo as deck cargo, may need to have the amount of cargo and resulting draft limited by stability considerations, the load line assignments of vessels, which are subject to the stability test requirements contained in § 31.10–30 in Subchapter D (Tank Vessels) or in Subpart 93.05 in Subchapter I (Cargo and Miscellaneous Vessels) of this chapter, shall in no case be deeper than permitted by the results of such tests.

(c) Load line assignments to vessels not subject to inspection will also be made subject to the results of a stability test if the design and service of the vessels are such as to indicate the need for a draft limitation based thereon.

(d) Load line assignments made to vessels before the results of stability tests are known shall be regarded as conditional and subject to verification by the Commandant.

(R.S. 4417, as amended, 4417a, as amended, secs. 1, 2, 49 Stat. 1544, as amended; 46 U.S.C. 391, 391a, 367)

### § 45.01–25 Marks to indicate maximum load lines.

(a) Marks to indicate maximum mean drafts to which a vessel can be lawfully submerged, in the various circumstances

and seasons, shall be permanently marked on each side of the vessel in the form, manner, and location provided by this part.

**§ 45.01–30 Assignment and certification of load lines; assigning authority.**

(a) As provided in the Coastwise Load Line Act, 1935, the American Bureau of Shipping is appointed to assign load lines and to determine whether the position of and the manner of marking each vessel to which the act applies has been performed in accordance with this part, and is authorized to issue a load line certificate, certifying to the correctness of the marks under its own hand and seal. As provided in the aforesaid act, the Commandant, U. S. Coast Guard may, at the request of a shipowner, appoint any other recognized classification society which he may approve, as the load line assigning authority. The American Bureau of Shipping (Mailing address: 45 Broad Street, New York, N.Y., 10004), or other approved load line assigning agency, is authorized to renew from time to time by endorsement a load line certificate. Load line certificates will not be issued until the load line marks have been verified. This certificate will be issued in duplicate, one copy being delivered to the owner or master of the vessel and one copy, together with a summary of the data used to determine the load line will be forwarded to the Commandant, U.S. Coast Guard, Washington, D.C., 20226. In addition, each new vessel, when receiving its first load line certificate, shall be furnished a copy of the load line survey report which shall be retained on board to be available for the information of inspectors and surveyors when carrying out subsequent load line surveys.

(b) The agency appointed by the Commandant, U. S. Coast Guard, to assign load lines as provided by section 3 of the Coastwise Load Line Act, 1935 (49 Stat. 888; 46 U. S. C. 88b), is referred to in this part as the assigning authority.

(c) The fees to be charged by the assigning authority for services in connection with this part shall not exceed the scale of maximum fees as set forth in § 45.20–75.

(Sec. 2, 45 Stat. 1493, as amended; 46 U.S.C. 85a)

**§ 45.01–35 Survey for the assignment of new load line and renewal of load line certificate.**

(a) *Steel vessels.* (1) Unless specifically waived by the Commandant, U.S. Coast Guard, the vessel is to be placed in drydock to determine the condition of the hull plating and underwater connections.

(2) The holds, 'tween decks, peaks, bilges, engine and boiler spaces, and bunkers are to be examined to determine the condition of the structure.

(3) Deep tanks and other tanks which form part of the vessel are to be examined internally.

(4) Where a double bottom is fitted, the tanks are to be examined internally. Where double bottom and other tanks are used for fuel oil bunkers, such tanks need not be cleaned out, provided the surveyors are able to determine by an external examination that their general condition is satisfactory.

(5) The decks are to be examined.

(6) The hatch covers, hatch beams, and fore-and-afters, tarpaulins, battens and wedges, the hatchway and ventilator coamings, companionways, the engine and boiler casings, the superstructures on the freeboard deck, and all means of protecting the openings in the freeboard deck and superstructures are to be examined.

(7) All air pipe outlets, scuppers, sanitary discharges in the vessel's sides, and air ports are to be examined.

(8) All gangways, cargo, and coaling ports or similar openings in the vessel's sides are to be examined.

(9) Guardrails, gangways, and freeing ports are to be examined.

(10) Where, owing to the age and condition of the vessel, the surveyors deem it necessary, the shell and deck plating may be required to be drilled in order to ascertain the thickness of such plating.

(b) *Wood and composite vessels.* (1) Unless specifically waived by the Commandant, U. S. Coast Guard, the vessel is to be placed on a drydock or a slipway and the keel, stem, sternframe or sternpost, and outside planking are to be examined. Caulking is to be tried at such places about the planking as is deemed necessary by the surveyors.

(2) Careful examination must be made for faulty fastenings and such bolts or treenails must be backed out, or otherwise dealt with, as may be deemed necessary by the surveyors.

(3) Careful examination is to be made of the entire structure and, if considered necessary, borings are to be made to ascertain the conditions of the material; should these disclose cause for further examination, listings are to be made where required to satisfy the surveyors as to the true condition of the vessel.

(4) The holds, 'tween decks, peaks, bilges, engine and boiler spaces, and bunkers are to be examined.

(5) The decks are to be examined and bored where necessary.

(6) The hatch covers, hatch beams, fore-and-afters, tarpaulins, battens, and wedges, the hatchway and ventilator coamings, companionways, the engine and boiler casings, the superstructures on the freeboard deck, and all means of protecting the openings in the freeboard deck and superstructures are to be examined.

(7) All air pipe outlets, scuppers, sanitary discharges in the vessel's sides, and air ports are to be examined.

(8) Guardrails, gangways, and freeing ports are to be examined.

(c) *Correction of deficiencies.* Any such structure or parts or fittings of the vessel as are found to be in an unsatisfactory condition are to be rebuilt or repaired or renewed in order to place the vessel in a seaworthy condition so as to be eligible for a load line certificate.

**§ 45.01–40 Annual load line inspection.**

(a) A vessel having been marked as provided by this part, and the mark certified as correct, will be inspected at intervals of approximately 12 months in order to insure the maintenance in an effective condition of the fittings and appliances for the:

(1) Protection of openings,

(2) guardrails,

(3) freeing ports,

(4) means of access to crew's quarters,

and that there have not been alterations made to the hull or superstructures, which would affect the calculations determining the position of the load lines.

(b) If upon examination the fittings and appliances are found to be in a satisfactory condition, the load line certificate will be endorsed to this effect. If it shall be found that alterations have been made to the hull or superstructures that affect the calculations determining the position of the load line, the matter shall be reported to the Commandant, U.S. Coast Guard, for appropriate action.

(c) The assigning authority shall make this inspection and report thereon to the owners of the vessel, and a copy of such report shall be forwarded to the Commandant, U. S. Coast Guard, Washington, D.C., 20226.

**§ 45.01–45 Application for assignment, renewal, and certification of load line marks.**

(a) Application for assignment and certification of load line marks or for renewal of load line certificates shall be made in writing to the assigning authority by the owners of the vessel.

**§ 45.01–50 Application for annual load line inspections.**

(a) Application for annual load line inspection required by § 45.01–40 shall be made in writing to the assigning authority by the owners of a vessel.

**§ 45.01–55 Equivalents.**

(a) Where in the regulations in this part it is provided that a particular fitting or appliance, or type thereof, shall be fitted or carried in a vessel, or that any particular arrangement shall be adopted, there may be substituted any other fitting or appliance or type thereof, or any other arrangement: *Provided*, That such fitting, appliance, or arrangement shall be considered a suitable equivalent by the assigning authority and the approval of the Commandant, U.S. Coast Guard, for such substitution shall have been issued.

**§ 45.01–60 Validity of certificates; renewal of certificates.**

(a) As the assignment of load lines is conditioned upon the structural efficiency of the vessel and upon the provision of effective protection to vessel and crew, every vessel required to be marked by the Coastwise Load Line Act, 1935, with load lines shall be surveyed by the assigning authority at least once in each 6 years to determine that the load lines are then correctly placed as required by this part. If the load line mark be found correct for the vessel in the condition she is then in, the certificate shall be renewed for such time as the condition of the

vessel then warrants, but in no case for a longer period than 6 years and the facts shall be attested by endorsement upon the back of the certificate in the form shown in § 45.25–5.

(b) The Commandant, U. S. Coast Guard, shall be notified of every renewal endorsement and the date of its expiration.

(c) Foreign vessels which have not been exempted pursuant to section 5 of the Load Line Act shall have their load line certificate limited to a period of 1 year. The certificate may be validated for additional 1-year periods (provided, after survey, the condition of the vessel is found to warrant such validation, and the facts are attested by endorsement upon the back of the load line certificate by a surveyor of the American Bureau of Shipping or of the classification society issuing the certificate.) The certificate will become void 5 years from date of issue, or at the expiration of the fourth yearly validation, whichever occurs first.

**§ 45.01–65 Form of certificate.**

(a) The form for certificates certifying to the correctness of the load line mark as required by the Coastwise Load Line Act, 1935, is shown in § 42.25–5.

**§ 45.01–70 Cancellation of load line certificate.**

(a) Notwithstanding the marking of a load line and the issuance of a load line certificate, the certificate will be cancelled if:

(1) The annual load line inspection required by § 45.01–40 has not been carried out or that the items described under § 45.01–40 are not maintained in an effective condition; or

(2) The survey required by § 45.01–35 has not been carried out, or that any defects disclosed by the survey have not been corrected; or

(3) Due to any cause the conditions of assignment have not been maintained as provided by the regulations in this part, or alterations have been made to hull or superstructures which affect the calculations made to determine the location of the load line.

**§ 45.01–75 Seasonal load lines.**

(a) For load line purposes there is hereby established for the Great Lakes a winter, intermediate, summer, and for tankers and cargo vessels (see §§ 45.01–15 and 45.01–17) a midsummer season, and load lines applicable to each season are established by the regulations in this part. The winter season shall be that period from November 1 through April 15 of the next year, the intermediate seasons from April 16 through April 30, and from October 1 through October 31, and the summer season from May 1 through September 30. The midsummer season shall be the portion of the summer season from May 1 through September 15 which shall be applicable only in those cases where midsummer season load lines are permitted. (All dates are inclusive.)

(b) For those vessels that are marked and certificated with load lines under the International Load Line Convention, 1930, the load line marks shall be applicable to voyages on the Great Lakes in accordance with Table 45.01–75 (b).

TABLE 45.01–75 (b)

| Load line mark. salt water: | *Season applicable* |
|---|---|
| Tropical (T) | May 1–Sept. 30 (summer). |
| Summer (S) | Apr. 16–30, Oct. 1–31 (intermediate). |
| Winter (W) | Nov. 1–Apr. 15 (winter). |

NOTE: In the case of cargo vessels and tankers as defined in §§ 45.01–15 and 45.01–17 loading to the tropical fresh water mark (TF) for the midsummer season may be authorized. In such cases a special supplementary certificate shall be issued.

(c) When engaged on voyages between the limits of Toledo Harbor and Port Huron, Michigan, cargo and tank vessels above 300 feet in length may load to their intermediate marks between October 1 and April 30, inclusive. Such vessels above 400 feet in length may load to their summer marks between September 16 and April 30, inclusive.

(d) Except as provided in paragraph (c) of this section, no vessel shall be loaded so as to submerge at any time the load line applicable to the season.

**§ 45.01–80 Logbook entries required.**

(a) It is the master's responsibility to have entered in the vessel's "Official Logbook" if carried, otherwise in a log considered as its official logbook, the data required by section 6 of the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88e). These logbook entries shall be made before a vessel departs from her loading port or place and consist of:

(1) A statement of the load line marks applicable to the voyage;

(2) A statement of the position of the load line mark, port and starboard, at the time of departing from a port or place; and,

(3) The actual drafts of the vessel, forward and aft, as nearly as the same can be ascertained, at the time of departing from a port or place.

**§ 45.01–85 Control.**

(a) The Collector of Customs or the Coast Guard District Commander may detain a vessel for survey if there is reason to believe that the vessel is proceeding on her journey in excess of the draft allowed by the regulations in this part as indicated by the vessel's load line certificate, or otherwise. The Coast Guard District Commander may detain a vessel if it is so loaded as to be manifestly unsafe to proceed.

(b) If the Collector of Customs orders a vessel detained, he shall immediately inform the Coast Guard District Commander thereof, who shall thereupon advise the Collector of Customs whether or not he deems that the vessel may proceed with safety. If the Coast Guard District Commander orders a vessel detained, such officer will furnish the Collector of Customs immediate notification of such detention. The clearance shall be refused to any vessel which shall have been ordered detained, which shall be in effect until it is shown that the vessel is not in violation of the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88i), and the regulations in this subchapter.

(c) The detention of a vessel will be by written order of either the Coast Guard District Commander or the Collector of Customs, depending on who orders the detention. The detaining officer will immediately arrange for a survey in the manner prescribed by section 7 of the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88f). Unless the owner or agent waives in writing and stipulates to accept the Coast Guard's survey, the detaining officer shall appoint three disinterested surveyors, and where practicable, one of them shall be from the Surveying Staff of the American Bureau of Shipping. Such surveyors shall conduct a survey to ascertain whether or not the vessel is loaded in violation of the applicable provisions of the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88i), and the regulations in this part. If the survey confirms the allegation that the vessel is in violation of the law or the regulations in this part "the owner and agent shall bear the costs of the survey in addition to any penalty or fine imposed," as provided in this law. When such surveyors are appointed by the Collector of Customs, such appointment shall be with the approval of the Coast Guard District Commander.

(d) Whenever a vessel is detained, the master or owner may, within five days, appeal to the Commandant, United States Coast Guard, who may, if he desires, order a further survey, and may affirm, set aside, or modify the order of the detaining officer.

(e) Where a foreign vessel is detained, or any action is taken which would appear likely to result in legal proceedings being taken against such a vessel, the consul of the country to which the vessel belongs shall be informed as soon as possible of the circumstances of the case.

(f) Pursuant to the provisions of section 5 of the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88d), it is hereby certified that a vessel of a foreign country which has ratified the International Load Line Convention, 1930, shall be deemed a vessel of a foreign country as described in section 5 of this act, and such a vessel shall be exempt from the provisions of the regulations in this part insofar as the marking of the load lines and the certificating thereof are concerned, only so long as such country similarly recognizes the load lines established by the regulations in this part, for the purpose of a voyage by sea: *Provided*, That the vessel is marked with load lines and has on board a valid load line certificate certifying to the correctness of the mark, the vessel shall not be loaded beyond the limits allowed by the certificate, the position of the load line of the vessel shall correspond with the certificate, the hull and superstructure shall not have been so materially altered as to affect the calculations on which the load line was based, and alterations have not been made so that the protection of openings, guardrails, freeing ports, and means of access to crew's quarters have made the vessel manifestly unfit to proceed to sea without danger to human life.

**§ 45.01–90 Approval of the Commandant.**

(a) Where the active approval of the Commandant, U.S. Coast Guard, is required in connection with this part, such information as will enable the Commandant, U.S. Coast Guard, to obtain a comprehensive understanding of the question at issue shall be furnished and will remain with the Commandant, U. S. Coast Guard, as a record.

## Subpart 45.05—General Rules for Determining Maximum Load Lines of Merchant Vessels on the Great Lakes

**§ 45.05–1 Definitions.**

(a) *Steamer.* (1) The term "steamer" or "steamship" includes all vessels having sufficient means for mechanical propulsion, except where provided with sufficient sail area for navigation under sails alone.

(2) A vessel fitted with mechanical means of propulsion and with sail area insufficient for navigation under sails alone may be assigned a load line under §§ 45.15–1—45.20–1.

(3) A lighter, barge, or other vessel without independent means of propulsion, when towed, is to be assigned a load line under §§ 45.15–1—45.20–1, except steel tank barges specially constructed for the carriage of liquids in bulk and cargo barges having only small access hatches in the freeboard deck, the load lines for which may be calculated under §§ 45.20–10—45.20–70.

(b) *Flushdeck vessel.* A flushdeck vessel is one which has no superstructure on the freeboard deck.

(c) *Superstructure.* A superstructure is a decked structure on the freeboard deck extending from side to side of the vessel. A raised quarter-deck is considered a superstructure.

(d) *Load line.* The load line is the line defining the maximum mean draft to which a vessel may be lawfully submerged. It is the lower limit of the freeboard as determined by the regulations in this part having regard to the various conditions and seasons.

(e) *Freeboard.* The freeboard assigned is the distance measured vertically downward at the side of the vessel amidships from the upper edge of the deck line to the upper edge of the load line.

(f) *Freeboard deck.* The freeboard deck is the deck from which the freeboard is measured, and is the uppermost complete deck having permanent means of closing all openings in weather portions of the deck in accordance with §§ 45.10–1—45.10–45. It is the upper deck in flushdeck vessels and vessels with detached superstructures. In vessels having discontinuous freeboard decks within superstructures which are not intact, or which are not fitted with class 1 closing appliances, the lowest line of the deck below the superstructure deck is taken as the freeboard deck.

(g) *Amidships.* Amidships is the middle of the length of the summer load waterline, as defined in § 45.15–1.

CROSS REFERENCE: For class 1 closing appliances, see § 45.15–37.

**§ 45.05–5 Deck line.**

(a) The deck line is a horizontal line 15 inches in length and 1 inch in breadth. It is to be marked amidships on each side of the vessel, and its upper edge is to pass through the point where the continuation outward of the upper surface of the freeboard deck intersects the outer surface of the shell. (See fig. 45.05–5 (a).) Where the deck is partly sheathed amidships, the upper edge of the deck line is to pass through the point where the continuation outward of the upper surface of the actual sheathing at amidships intersects the outer surface of the shell.

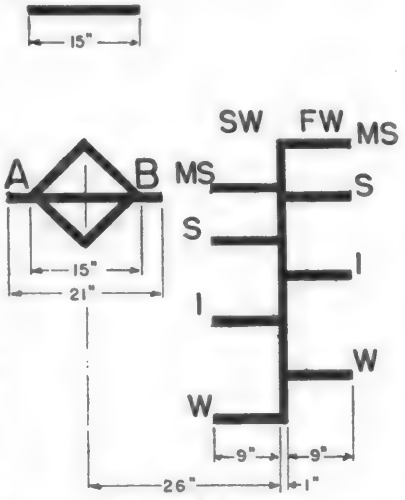



FIGURE 45.05–5(a).

NOTE: The line marked "MS" shall be used only when applicable to vessels defined in §§ 45.01–15 and 45.01–17.

**§ 45.05–10 Load line diamond.**

(a) The load line diamond is a square 15 inches on each diagonal with one diagonal vertical, the other horizontal, and is intersected by a horizontal line of 21 inches in length and 1 inch in breadth, the upper edge of which coincides with the horizontal diagonal of the diamond. The diamond is to be marked amidships below the deck line, port and starboard.

**§ 45.05–15 Lines to be used in connection with the diamond.**

(a) The lines which indicate the maximum load line in different seasons are to be horizontal lines, 9 inches in length and 1 inch in breadth, which extend from and are at right angles to a vertical line marked 26 inches forward of the center of the diamond. (See Figure 45.05–5(a).)

(b) The following are the lines to be used:

(1) *Midsummer load line.* The midsummer load line is indicated by the upper edge of a line marked "MS".

(2) *Summer load line.* The summer load line is indicated by the upper edge of the line which passes through the center of the diamond and also by a line marked "S".

(3) *Intermediate load line.* The intermediate load line is indicated by the upper edge of a line marked "I".

(4) *Winter load line.* The winter load line is indicated by the upper edge of a line marked "W".

(5) *Salt water load lines.* Ships which load in salt water of the St. Lawrence River and proceed to fresh water shall additionally be marked with horizontal lines, 9 inches in length and 1 inch in breadth extending from the vertical line referred to above towards the diamond. These lines shall be indicated as "S.W." marks and shall be additionally marked to indicate the corresponding Great Lakes season.

(c) Where the draft is restricted on a basis of subdivision or stability and this draft is less than any of the various seasonal drafts permitted by the regulations in this part, the center of the diamond shall be located on the line of this restricted draft and it shall be applicable to all seasons. If such a permissible maximum draft comes between the seasonal markings, the seasonal markings below shall also be added.

CROSS REFERENCE: For determining the salt water freeboard, see § 45.15–96.

**§ 45.05–20 Mark of assigning authority.**

(a) The authority by whom the load lines are assigned may be indicated by letters measuring about 4½ by 3 inches marked alongside the diamond and above the centerline.

**§ 45.05–25 Details of marking.**

(a) The diamond, lines, and letters are to be painted in white or yellow on a dark ground or in black on a light ground. They are also to be carefully cut in or center punched on the sides of iron and steel vessels, and on wood vessels they are to be cut into the planking for at least one eighth of an inch. The marks are to be plainly visible, and if necessary special arrangements are to be made for this purpose.

**§ 45.05–30 Verification of marks.**

(a) The load line certificate is not to be delivered to the vessel until a surveyor of the assigning authority has certified that the marks are correctly and permanently indicated on the vessel's side.

## Subpart 45.10—Conditions of Assignment of Load Lines

**§ 45.10–1 Construction of vessel.**

(a) The assignment of load lines is conditional upon the vessel being structurally efficient and upon the provision of effective protection to vessel and crew.

(b) Sections 45.10–1—45.10–100 apply to vessels to which minimum freeboards are assigned. In vessels to which greater freeboards than the minimum are assigned, the protection is to be relatively as effective.

(c) Passenger vessels—Subdivision and stability load lines: Where in passenger vessels the positions of the maximum load lines are determined by the application of subdivision and stability regulations as provided in Part 46 of this subchapter pertaining to passenger vessels on the Great Lakes, the provisions of the regulations in this part shall also be effective insofar as they are applicable.

(R.S. 4491, as amended, sec. 5, 49 Stat. 1384, as amended; 46 U.S.C. 391, 369)

**§ 45.10–5 Cargo and other hatchways not protected by superstructures.**

(a) The construction and fittings of cargo and other hatchways in exposed positions on freeboard and superstructure decks are to be at least equivalent to the standards laid down in §§ 45.10–10—45.10–45.

(b) Where hatch covers are of adequate metal construction, sealed watertight against pliable gaskets by dogs or other suitable means, as approved by the Load Line Assigning Authority, the application of the requirements of §§ 45.10–10—45.10–45 will be modified accordingly.

**§ 45.10–10 Hatchway coamings.**

(a) The minimum height of hatchway coamings on freeboard decks is to be at least 18 inches above the deck. The minimum height of coamings on superstructure decks is to be at least 18 inches above the deck if situated within a quarter of the vessel's length from the stem, and at least 12 inches if situated elsewhere.

**§ 45.10–15 Hatchway covers.**

(a) On bulk freighters over 350 feet in length steel hatch covers are to be fitted to all exposed hatchways on the freeboard deck and they are to be of such thickness and provided with such stiffening as will enable them to be handled without deformation.

(b) Solid covers are to have stiffeners spaced not over 42 inches apart. The plating is to be not less than 0.24'' at 24-inch spacing and 0.36'' at 42-inch spacing with intermediate thicknesses at intermediate spacings. The stiffeners are not to be less effective than provided by angles, bulb angles or channels riveted or welded to the plate and having a section modulus in inches cubed not less than given by the formula:

$$I/y = S \times L^2 \times 0.025 \quad (1)$$

where:

$S$ = spacing of stiffeners in feet.
$L$ = length in feet of the unsupported spans.
$I$ = moment of inertia of the section.
$y$ = distance from center of gravity of the section to the outermost strain fiber.

(c) Covers of the sliding plate type with flanges on one edge or with stiffeners riveted or welded to one edge shall have a sufficient number of sections so that when closed the spacing of the stiffeners does not exceed 42 inches. Plates are not to be less in thickness than required for solid steel covers in association with the spacing of the stiffeners when closed. The stiffening at the edge of the covers is not to be less effective than required above for solid covers. If hatch covers of the sliding plate type are used for spans exceeding 12'—1'', additional support must be provided, the details of which will be specially considered.

(d) Where wood hatch covers are used they are to be made of long leaf yellow pine or fir and the finished thickness is not to be less than 2¼ inches in association with a span of 6 feet. The width of each bearing surface is to be at least 2½ inches.

**§ 45.10–20 Hatchway beams.**

(a) Hatchways having wood covers are to be fitted with a system of main beams all extending in one direction or a system of main beams in association with auxiliary beams across the top of the main beams so arranged that the unsupported spans of the covers do not exceed 6 feet except where specially approved. The main beams may be of solid, rolled, or built shapes and the auxiliary beams may be either rolled shapes or timber of rectangular section. They are to have a section modulus in inches cubed of not less than given by the formula.

$$I/y = S \times L^2 \times C \quad (1)$$

where:

$S$ = the breadth of the area supported in feet.
$L$ = the length of the unsupported spans in feet.
$C$ = 0.03 for steel main beams where 18'' coamings are required.
$C$ = 0.025 for steel auxiliary beams where 18'' coamings are required.
$C$ = 0.025 for steel main beams where 12'' coamings are required.
$C$ = 0.02 for steel auxiliary beams where 12'' coamings are required.
$C$ = 0.15 for wood auxiliary beams where 18'' coamings are required.
$C$ = 0.12 for wood auxiliary beams where 12'' coamings are required.
$I$ = moment of inertia of the section.
$y$ = distance from center of gravity of the section to the outermost strain fiber.

(b) Where rolled section beams are used the top flanges and the top angles in the case of built beams are to extend for the full length of the beams. Where wood auxiliary beams are used they are to be steel shod at all points where they bear on the main beams and at the ends.

**§ 45.10–25 Carriers or sockets.**

(a) Carriers or sockets for hatchway beams and fore-and-afters are to be of steel at least one-half inch thick, and are to have a width of bearing surface of at least 3 inches.

**§ 45.10–30 Cleats and fasteners.**

(a) Strong cleats at least 2½ inches wide or efficient clamping devices are to be fitted at intervals of approximately 2 feet from center to center; the end cleats are to be placed not more than 6 inches from each corner of the hatchway. Where steel sliding covers are fitted, patent fasteners of the "Mulholland type" or equal, spaced to suit the width of covers, may be used in place of cleats and wedges.

**§ 45.10–35 Battens and wedges.**

(a) Battens, wedges, or tarpaulin securing devices are to be efficient and in good condition.

**§ 45.10–40 Tarpaulins.**

(a) At least one tarpaulin in good condition, thoroughly waterproofed, and of ample strength, is to be provided for each hatchway in an exposed position on freeboard and superstructure decks. The material is to be guaranteed free from jute, and shall not be less than No. 4 cotton canvas or equal before waterproofing, or shall be of suitable synthetic fabric as approved for this purpose by the Load Line Assigning Authority.

**§ 45.10–45 Security of hatchway covers.**

(a) At all hatchways in exposed positions on freeboard or superstructure decks suitable provision is to be made for securing the covers after the tarpaulins are battened down.

**§ 45.10–50 Cargo and other hatchways in the freeboard deck within superstructures which are fitted with closing appliances less efficient than class 1.**

(a) The construction and fitting of such hatchways are to be at least equivalent to the standards laid down in §45.10–55 (a).

**§ 45.10–55 Hatchway coamings and closing arrangements.**

(a) Cargo, coaling, and other hatchways in the freeboard deck within superstructures which are fitted with class 2 closing appliances are to have coamings at least 9 inches in height and closing arrangements as effective as those required for exposed cargo hatchways.

(b) Where the closing appliances are less efficient than class 2, the hatchways are to have coamings at least 12 inches in height and are to have fittings and closing arrangements as effective as those required for exposed cargo hatchways.

(c) In the case of car ferries fitted with efficient "sea gates" extending above the freeboard deck at least to the height of a standard superstructure, coamings of less height may be fitted provided the hatches within superstructures are fitted with close fitting steel covers with efficient securing devices. When the openings in freeboard decks are not provided with closing devices the coamings are to extend above the freeboard deck at least to the height of a standard superstructure.

CROSS REFERENCE: For class 2 closing appliances, see § 45.15–40.

**§ 45.10–57 Machinery space openings in exposed positions on freeboard and raised quarter-decks.**

(a) Such openings are to be properly framed and efficiently enclosed by steel casings of ample strength, and where the casings are not protected by other structures their strength is to be specially considered; doors in such casings are to be of steel, efficiently stiffened, permanently attached, and capable of being closed and secured from both sides. The sills of openings are to be at least 18 inches above the freeboard deck and 12 inches on a raised quarter-deck.

(b) Fiddley, funnel, and ventilator coamings are to be as high above the deck as is reasonable and practicable. Fiddley openings are to have strong steel covers permanently attached in their proper positions. Engineroom skylights are to be of strong construction, preferably of steel.

**§ 45.10–60 Machinery space openings in exposed positions on superstructure decks other than raised quarter-decks.**

(a) Such openings are to be properly framed and efficiently enclosed by strong

steel casings. Doors in such cases are to be strongly constructed, permanently attached, and capable of being closed and secured from both sides. The sills of the openings are to be at least 9 inches above superstructure decks.

(b) Fiddley, funnel, and ventilator coamings are to be as high above the deck as is reasonable and practicable. Fiddley openings are to have strong steel covers permanently attached in their proper positions. Where the fiddley openings are more than 15 feet in height above the freeboard deck, covers need not be provided.

(c) Engineroom skylights are to be of strong construction, preferably of steel.

**§ 45.10–65 Machinery space openings in the freeboard deck within superstructures which are fitted with closing appliances less efficient than class 1.**

(a) Such openings are to be properly framed and efficiently enclosed by steel casings. Doors in such casings are to be strongly constructed, permanently attached, and capable of being securely closed. The sills of the openings are to be at least 6 inches above the deck where the superstructures are closed by class 2 closing appliances, and at least 12 inches above the deck where the closing appliances are less efficient than class 2.

CROSS REFERENCE: For class 2 closing appliances, see § 45.15–40.

**§ 45.10–67 Flush scuttles.**

(a) Flush scuttles, where fitted, are to be of iron or steel, of substantial construction, with screw or bayonet joints.

**§ 45.10–70 Companionways.**

(a) Companionways in exposed positions on freeboard decks and on decks of enclosed superstructures are to be of substantial construction. The sills of the doorways are to be 18 inches on freeboard decks and on superstructure decks within a quarter of the vessel's length from the stem and 12 inches on superstructure decks elsewhere. The doors are to be strongly constructed and capable of being closed and secured from both sides. Where the companionway is situated within a quarter of the vessel's length from the stem, it is to be of steel and riveted to the deck plating.

**§ 45.10–75 Ventilators in exposed positions on freeboard and superstructure decks.**

(a) Such ventilators to spaces below freeboard decks or decks of superstructures which are intact or fitted with class 1 closing appliances are to have coamings of steel, substantially constructed and sufficiently connected to the deck. The deck plating at the base of the coamings is to be efficiently stiffened between the deck beams. The openings of ventilator coamings are to be provided with efficient closing arrangements.

(b) Where such ventilators are situated on the freeboard deck, or on the superstructure deck within a quarter of the vessel's length from the stem, and the closing arrangements are of a temporary character, the coamings are to be at least 30 inches in height; in other exposed positions on the superstructure deck they are to be at least 24 inches in height. Where the coaming of any ventilator exceeds 36 inches in height, it is to be specially supported and secured.

**§ 45.10–77 Air pipes.**

(a) Where the air pipes to ballast and other tanks extend above the freeboard or superstructure decks, the exposed parts of the pipes are to be of substantial construction; the height from the deck to the opening is to be, when practical, at least 30 inches in wells on freeboard decks, 24 inches on raised quarter-decks, and 12 inches on other superstructure decks. Satisfactory means are to be provided for closing the openings of the air pipes. Where these heights may interfere with the working of the vessel a lower height may be approved provided the air pipe cap is properly protected and the air pipe is fitted with adequate means of closing.

**§ 45.10–80 Gangway, cargo, and coaling ports, etc.**

(a) Openings in the sides of vessels below the freeboard deck are to be fitted with watertight doors or covers, which, with their securing appliances, are to be of sufficient strength.

**§ 45.10–85 Scuppers and sanitary discharge pipes.**

(a) Discharges from scuppers and sanitary pipes led through the vessel's sides from spaces below the freeboard deck are to be fitted with efficient and accessible means for preventing water from passing inboard. Each separate discharge may have an automatic nonreturn valve with a positive means of closing it from a readily accessible position above the freeboard deck, or two automatic nonreturn valves without positive means of closing, provided the upper valve is situated so that it is always accessible for examination under service conditions. The positive-action valve is to be accessible and is to be provided with means for showing whether the valve is open or closed.

(b) Conditional upon the type and the location of the inboard ends of such openings, similar provisions may be prescribed by the assigning authority as to discharge from spaces within enclosed superstructures.

(c) Where scuppers are fitted in superstructures not fitted with class 1 closing appliances they are to have efficient means for preventing the accidental admission of water below the freeboard deck.

**§ 45.10–87 Air ports.**

(a) Air ports to spaces below the freeboard deck or to spaces below the superstructure deck of superstructures, closed by class 1 or class 2 closing appliances, are to be fitted with efficient inside deadlights permanently attached in their proper positions so that they can be effectively closed and secured watertight. Where, however, such spaces in superstructures are appropriated to passengers other than steerage passengers or to crew, the air ports may have portable deadlights stowed adjacent to the air ports, provided they are readily accessible at all times on service.

(b) The air ports and deadlights are to be of substantial and approved construction.

CROSS REFERENCE: For class 1 and class 2 closing appliances, see §§ 45.15–37, 45.15–40.

**§ 45.10–90 Guardrails.**

(a) Efficient guardrails or bulwarks are to be fitted on all exposed portions of freeboard and superstructure decks.

**§ 45.10–95 Freeing ports.**

(a) Where bulwarks on the weather portions of freeboard or superstructure decks form "wells" ample provision is to be made for rapidly freeing the decks of water and for draining them. The minimum freeing port area on each side of the vessel for each well on the freeboard deck and on the raised quarter-deck is to be that given by the following scale: The minimum area for each well on any other superstructure deck is to be one-half the area given by the scale. Where the length of the well exceeds .7*L*, the scale may be modified.

TABLE 45.10–95 (a)—SCALE OF FREEING PORT AREA

| Length of bulwarks in "well" in feet | Freeing port area on each side in square feet | Length of bulwarks in "well" in feet | Freeing port area on each side in square feet |
|---|---|---|---|
| 15 | 8.0 | 45 | 11.0 |
| 20 | 8.5 | 50 | 11.5 |
| 25 | 9.0 | 55 | 12.0 |
| 30 | 9.5 | 60 | 12.5 |
| 35 | 10.0 | 65 | 13.0 |
| 40 | 10.5 | Above 65 | (1) |

[1] 1 square foot for each additional 5 feet length of bulwark.

(b) The lower edges of the freeing ports are to be as near the deck as practicable and preferably not higher than the upper edge of the gunwale bar. Two thirds of the freeing port area required is to be provided in the midship half of the well. In vessels with less than the standard sheer the freeing port area is to be suitably increased.

(c) All such openings in the bulwarks are to be protected by rails or bars spaced about 9 inches apart. If shutters are fitted to freeing ports, ample clearance is to be provided to prevent jamming. Hinges are to have brass pins.

**§ 45.10–100 Protection of crew.**

Gangways, lifelines, or other satisfactory means are to be provided for the protection of the crew in getting to and from their quarters.

## Subpart 45.15—Load Lines for Steamers [1]

**§ 45.15–1 Length (L).**

(a) The length used with the rules and the freeboard tables is the length in feet on the summer load waterline from the foreside of the stem to the afterside of the rudder post. Where there is no rud-

[1] The provisions of §§ 45.01–1–45.01–90, inclusive, and §§ 45.05–1–45.10–100, inclusive, apply to all vessels having Great Lakes load lines and, for steamers, are supplemented by §§ 45.15–1–45.15–97, inclusive. Tankers having Great Lakes load lines are also subject to these requirements except as specifically modified in §§ 45.20–1–45.20–70, inclusive.

der post, the length is measured from the foreside of the stem to the axis of the rudder stock. For vessels with cruiser sterns, the length is to be taken as 96 percent of the total length on the designed summer load waterline or as the length from the foreside of the stem to the axis of the rudder stock if that be the greater.

**§ 45.15–5 Breadth (B).**

(a) The breadth is the maximum breadth in feet amidships to the molded line of the frame in iron or steel vessels and to the outside of the planking in wood or composite vessels.

**§ 45.15–7 Molded depth.**

(a) The molded depth is the vertical distance in feet, measured amidships, from the top of the keel to the top of the freeboard deck beam at side. In wood and composite vessels the distance is measured from the lower edge of the keel rabbet. Where the form at the lower part of the midship section is of a hollow character, or where thick garboards are fitted, the depth is measured from the point where the line of the flat of the bottom continued inwards cuts the side of the keel.

**§ 45.15–10 Depth for freeboard (D).**

(a) The depth used with the freeboard table is the molded depth plus the thickness of stringer plate, or plus

$$\frac{T(L-S)}{L} \quad (1)$$

if that be greater, where

$T$ is the mean thickness of the exposed deck clear of deck openings, and

$S$ is the total length of superstructures as defined in § 45.15–27.

(b) Where the topsides are of unusual form, $D$ is the depth of a midship section having vertical topsides, standard round of beam, and area of topside section equal to that in the actual midship section. Where there is a step or break in the topsides (that is, as in the turret-deck vessel) 70 percent of the area above the step or break is included in the area used to determine the equivalent section.

(c) In a vessel without an enclosed superstructure covering at least $0.6L$ amidships, without a complete trunk or without a combination of intact partial superstructures and trunk extending all fore and aft, the depth to be used with the freeboard table is not to be less than $L/15$ in vessels below 350 feet in length, nor less than those tabulated below for lengths above 350 feet (minimum depths at intermediate lengths are obtained by interpolation).

TABLE 45.15–10 (a)—FREEBOARD TABLE

| L | Minimum depth | L | Minimum depth | L | Minimum depth |
|---|---|---|---|---|---|
| 350 | 23.35 | 450 | 27.65 | 550 | [illegible] |
| 375 | 24.70 | 475 | 28.40 | 575 | 30.70 |
| 400 | 25.80 | 500 | 29.05 | 600 | 31.15 |
| 425 | 26.80 | 525 | [illegible] | 625 | 31.60 |

**§ 45.15–15 Coefficient of fineness (c).**

(a) The coefficient of fineness used with the freeboard table is given by

$$c=\frac{\Delta}{L.B.d_1} \quad (1)$$

Where $\Delta$ is the volume in cubic feet of the vessel's molded displacement excluding bossing at a mean molded draft $d_1$ which is 85 percent of the molded depth. The coefficient $c$ is not to be taken as less than 0.68, nor more than 0.86.

**§ 45.15–17 Strength.**

(a) The assigning authority is to be satisfied with the structural strength of vessels to which freeboards are assigned.

(b) Vessels which comply with the highest standard of the rules of a classification society recognized by the Commandant, U. S. Coast Guard, shall be regarded as having sufficient strength for the minimum freeboards allowed under Commandant, U. S. Coast Guard, in this part.

(c) Vessels which do not comply with the highest standard of the rules of a classification society recognized by the Commandant, U.S. Coast Guard, shall be assigned such increased freeboards as shall be determined by the assigning authority, and for guidance the following strength moduli are formulated:

(1) *Material.* The strength moduli are based on the assumption that the structure is built of mild steel, manufactured by the open-hearth process (acid or basic), and having a tensile strength of 60,000 to 72,000 pounds per square inch, and a minimum elongation on a length of 8 inches of at least

$$\frac{1{,}500{,}000}{\text{Tensile strength}}$$

(2) *Strength deck.* The strength deck is the uppermost deck which is incorporated into and forms an integral part of the longitudinal girder within the half-length amidships.

(3) *Depth to strength deck (Ds).* The depth to strength deck is the vertical distance in feet amidships from the top of the keel to the top of the strength deck beam at side.

(4) *Draft (d).* The draft is the vertical distance in feet amidships from the top of the keel to the center of the diamond except in those cases where midsummer marks are granted, the draft to be used is the draft to the midsummer mark.

(5) *Longitudinal modulus.* The longitudinal modulus $\frac{I}{y}$ is the moment of inertia $I$ of the midship section about the neutral axis divided by the distance $y$ measured from the neutral axis to the top of the strength deck beam at side, calculated in way of openings but without deductions for rivet holes. Areas are measured in square inches and distances in feet.

(i) Below the strength deck, all continuous longitudinal members other than such parts of underdeck girders as are required entirely for supporting purposes are included. Above the strength deck, the gunwale angle bar and the extension of the sheerstrake are the only members included.

(ii) The required longitudinal modulus for effective material is expressed by f. d. B., where $f$ is the factor obtained from the Table 45.15–17 (c) (5) (ii).

TABLE 45.15–17 (c) (5) (ii)

| L | f | L | f | L | |
|---|---|---|---|---|---|
| 100 | 1.70 | 280 | 5.70 | 460 | 11.10 |
| 120 | 1.95 | 300 | 6.30 | 480 | 11.70 |
| 140 | 2.20 | 320 | 6.90 | 500 | 12.30 |
| 160 | 2.50 | 340 | 7.50 | 520 | 12.90 |
| 180 | 2.90 | 360 | 8.10 | 540 | 13.50 |
| 200 | 3.40 | 380 | 8.70 | 560 | 14.10 |
| 220 | 3.90 | 400 | 9.30 | 580 | 14.70 |
| 240 | 4.50 | 420 | 9.90 | 600 | 15.30 |
| 260 | 5.10 | 440 | 10.50 | 620 | 15.90 |

(iii) For intermediate lengths, the value of $f$ is determined by interpolation.

(iv) This formula applies where the ratio $\frac{L}{D_s}$ does not exceed 13.5 in vessels of 325 feet length and under and 19 in vessels of 600 feet length and above. Intermediate values between lengths of 325 feet and 600 feet length are to be obtained by interpolation.

(6) *Frame.* For the purpose of the frame modulus, the frame is regarded as composed of a frame angle and a reverse angle each of the same size and thickness.

(7) *Frame modulus.* The modulus $\frac{I}{y}$ of the midship frame below the lowest tier of beams is the moment of inertia $I$ of the frame section about the neutral axis divided by the distance $y$ measured from the neutral axis to the extremity of the frame section, calculated without deduction for rivet and bolt holes. The modulus is measured in inch units.

(i) The required frame modulus is expressed by

$$\frac{s\ (d-t)\ (f_1+f_2)}{1{,}000} \quad (2)$$

where:

$s$ is the frame spacing in inches.

$t$ is the vertical distance in feet measured at amidships from the top of the keel to a point midway between the top of the inner bottom at side and the top of the heel bracket (see fig. 45.15–17 (c) (7) (i)); where there is no double bottom, $t$ is measured to a point midway between the top of the floor at center and the top of the floor at the side.

$f_1$ is a coefficient depending on $H$, which, in vessels fitted with double bottoms, is the vertical distance in feet from the middle of the beam bracket of the lowest tier of beams at side to a point midway between the top of the inner bottom at side and the top of the heel bracket (see fig. 45.15–17 (c) (7) (i)); where there is no double bottom, $H$ is measured to a point midway between the top of the floor at center and the top of the floor at side. Where the frame obtains additional strength from the form of the vessel, due allowance is made in the value of $f_1$.

$f_2$ is a coefficient depending on $K$ which is the vertical distance in feet from the top of the lowest tier of beams at side to a point 7 feet, 6 inches above the freeboard deck at side, or, if there is a superstructure, to a point 12 feet 6 inches above the freeboard deck at side. (See fig. 45.15–17 (c) (7) (i).) The values of $f_1$ and $f_2$ are obtained from Table 45.15–17 (c) (7) (i).

TABLE 45.15–17 (c) (7) (i)

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $H$ in feet | 0 | 7.0 | 9.0 | 11.0 | 13.0 | 15.0 | 17.0 | 19.0 | 21.0 | 23.0 | 25.0 |
| $f_1$ | 9 | 11.0 | 12.5 | 15.0 | 19.0 | 24.0 | 29.5 | 36.0 | 43.0 | 51.0 | 59.0 |
| $K$ in feet | 0 | 5.0 | 10.0 | 15.0 | 20.0 | 25.0 | 30.0 | 35.0 | 40.0 | ------ | ------ |
| $f_2$ | 0 | .5 | 1.0 | 2.0 | 3.0 | 4.5 | 6.5 | 9.0 | 12.0 | ------ | ------ |

NOTE: Intermediate values are obtained by interpolation.

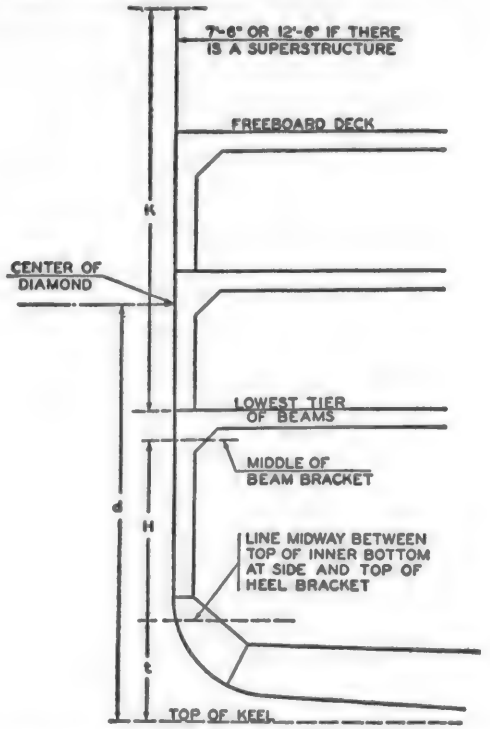



FIGURE 45.15–17 (c) (7) (i)

(ii) This formula applies where $D$ is between 15 feet and 60 feet, both inclusive;

$B$ is between $\frac{L}{10}+5$ and $\frac{L}{10}+20$, both inclusive;

$\frac{L}{Ds}$ is between 10 and 13.5, both inclusive; and the horizontal distance from the outside of the frame to the center of the first row of pillars does not exceed 20 feet.

(iii) In single-deck vessels of ordinary form, where $H$ does not exceed 18 feet, the frame modulus determined by the preceding method is multiplied by the factor $f_3$ where

$$f_3=0.50+0.05\ (H-8)$$

(iv) Where the horizontal distance from the outside of the frame to the center of the first row of pillars exceeds 20 feet, the assigning authority is to be satisfied that sufficient additional strength is provided.

### § 45.15–20 Height of superstructure.

(a) The height of a superstructure is the least vertical height measured from the top of the superstructure deck to the top of the freeboard deck beam minus the difference between $D$ and the molded depth. (See §§ 45.15–7, 45.15–10.)

### § 45.15–25 Standard height of superstructure.

(a) The standard height of a raised quarter-deck is 3 feet for vessels up to and including 100 feet in length, 4 feet for vessels 250 feet in length, and 6 feet for vessels 400 feet in length and above. The standard height of any other superstructure is 6 feet for vessels up to and including 250 feet in length and 7 feet 6 inches for vessels 400 feet in length and above. The standard height at intermediate lengths is obtained by interpolation.

### § 45.15–27 Length of superstructure (S).

(a) The length of a superstructure is the mean covered length of the parts of the superstructure which extend to the sides of the vessel and lie within lines drawn perpendicular to the extremities of the summer load waterline, as defined in § 45.15–1.

### § 45.15–30 Enclosed superstructure.

(a) A detached superstructure is regarded as enclosed only where:

(1) The enclosing bulkheads are of efficient construction. (See § 45.15–35.)

(2) The access openings in these bulkheads are fitted with class 1 or class 2 closing appliances. (See §§ 45.15–37, 45.15–40.)

(3) All other openings in sides or ends of the superstructure are fitted with efficient weathertight means of closing.

(4) Independent means of access to crew, machinery, bunker, and other working spaces within bridges and poops are at all times available when the bulkhead openings are closed.

### § 45.15–35 Superstructure bulkheads.

(a) Bulkheads at exposed ends of poops, bridges, and forecastles are deemed to be of efficient construction where the assigning authority is satisfied that, in the circumstances, they are equivalent to the following standard for vessels with minimum freeboards under which standard the stiffeners and plating are of the scantlings given in Table 45.15–35(a), the stiffeners are spaced 30 inches apart, the stiffeners on poop and bridge front bulkheads have efficient end connections, and those on after bulkheads of bridges and forecastles extend for the whole distance between the margin angles of the bulkheads.

TABLE 45.15–35 (a)—EXPOSED BULKHEADS OF SUPERSTRUCTURES OF STANDARD HEIGHT [1]

| Bridge front bulkheads, unprotected bulkheads of poops $0.4L$ or more in length | | Bulkheads of poops partially protected or less in length than $0.4L$ | | After bulkheads of bridges and forecastles | |
|---|---|---|---|---|---|
| Length of vessel (feet) | Bulb angle stiffeners (inches) | Length of vessel (feet) | Plain angle stiffeners (inches) | Length of vessel (feet) | Plain angle stiffeners (inches) |
| Under 160 | 5½ x 3 x 0.32. | Under 150 | 3 x 2½ x 5/16. | Under 150 | 2½ x 2¼ x ¼. |
| 160 | 6 x 3 x 0.34. | 150 | 3½ x 2½ x 5/16. | 150 | 3½ x 2½ x ¼. |
| 200 | 7 x 3 x 0.32. | 200 | 4 x 3 x 5/16. | 250 | 3½ x 3 x 5/16. |
| 240 | 7 x 3 x 0.38. | 250 | 5 x 3 x 5/16. | 350 and above | 4 x 3 x 5/16. |
| 280 | 7 x 3 x 0.44. | 300 | 5 x 3 x 3/8. | | |
| 320 | 8 x 3 x 0.40. | 350 | 6 x 3½ x 3/8. | | |
| 360 | 8 x 3 x 0.46. | 400 | 6 x 3½ x 7/16. | | |
| 400 | 9 x 3½ x 0.38. | 450 | 7 x 3½ x 7/16. | | |
| 440 | 9 x 3½ x 0.50. | 500 and above | 7 x 3½ x ½. | | |
| 480 | 10 x 3½ x 0.40. | | | | |
| 520 | 10 x 3½ x 0.52. | | | | |
| 560 and above | 10 x 3½ x 0.64. | | | | |

| Length of vessel (feet) | Bulkhead plating (inch) | Length of vessel (feet) | Bulkhead plating (inch) | Length of vessel (feet) | Bulkhead plating (inch) |
|---|---|---|---|---|---|
| 200 and under | 0.3 | 160 and under | 0.24 | 160 and under | 0.20 |
| 380 and above | 0.44 | 400 and above | 0.38 | 400 and above | 0.30 |

[1] For vessels intermediate in length the thickness of bulkhead plating is obtained by interpolation.

**§ 45.15–37 Class 1 closing appliances.**

(a) These appliances are of iron or steel, are in all cases to be permanently and strongly attached to the bulkhead, are framed, stiffened, and fitted so that the whole structure is of equivalent strength to the unpierced bulkhead, and are weathertight when closed. The means for securing these appliances are permanently attached to the bulkhead or to the appliances and the latter are so arranged that they can be closed and secured from both sides of the bulkhead or from the deck above. The sills of the access openings are at least 12 inches above the deck.

**§ 45.15–40 Class 2 closing appliances.**

(a) These appliances are (1) strongly framed hardwood hinged doors, which are not more than 30 inches wide nor less than 2 inches thick, or (2) shifting boards fitted for the full height of the opening in channels riveted to the bulkhead, the shifting boards being at least 2 inches thick where the width of opening is 30 inches or less, and increased in thickness at the rate of 1 inch for each additional 15 inches of width, or (3) portable plates of equal efficiency.

**§ 45.15–45 Temporary closing appliances.**

(a) Temporary closing appliances for middle line openings in the deck of an enclosed superstructure consists of: (1) a steel coaming not less than 9 inches in height efficiently riveted to the deck; (2) hatchway covers as required by § 45.10–15, secured by hemp lashings; and (3) hatchway supports as required by §§ 45.10–20, 45.10–25.

**§ 45.15–47 Superstructures, general.**

(a) Where exposed bulkheads at the ends of poops, bridges, and forecastles are not of efficient construction (see § 45.15–35), they are considered as nonexistent.

(b) Where in the side plating of a superstructure there is an opening not provided with permanent means of closing, the part of the superstructure in way of the opening is regarded as having no effective length.

(c) Where the height of a superstructure is less than the standard its length is reduced in the ratio of the actual to the standard height. Where the height exceeds the standard, no increase is made in the length of the superstructure.

**§ 45.15–50 Poop.**

(a) Where there is an efficient bulkhead and the access openings are fitted with class 1 closing appliances, the length to the bulkhead is effective. Where the access openings in an efficient bulkhead are fitted with class 2 closing appliances and the length to the bulkhead is 0.5 $L$ or less, 100 percent of that length is effective; where the length is 0.7 $L$ or more, 90 percent of that length is effective; where the length is between 0.5 $L$ and 0.7 $L$, an intermediate percentage of that length is effective; where an allowance is given for an efficient adjacent trunk (see § 45.15–65), 90 percent of the length to the bulkhead is to be taken as effective; 50 percent of the length of an open poop or of an open extension beyond an efficient bulkhead is effective.

CROSS REFERENCE: For class 2 closing appliances, see § 45.15–40.

**§ 45.15–55 Raised quarter-deck.**

(a) Where there is an efficient intact bulkhead, the length to the bulkhead is effective. Where the bulkhead is not intact, the superstructure is considered as a poop of less than standard height.

**§ 45.15–57 Bridge.**

(a) Where there is an efficient bulkhead at each end, and the access openings in the bulkheads are fitted with class 1 closing appliances, the length between the bulkheads is effective.

(b) Where the access openings in the forward bulkhead are fitted with class 1 closing appliances and the access openings in the after bulkhead with class 2 closing appliances, the length between the bulkheads is effective; where an allowance is given for an efficient trunk, adjacent to the after bulkhead (see § 45.15–65), 90 percent of the length is effective. Where the access openings in both bulkheads are fitted with class 2 closing appliances, 90 percent of the length between the bulkheads is effective. Where the access openings in the forward bulkhead are fitted with class 1 or class 2 closing appliances and the access openings in the after bulkhead have no closing appliances, 75 percent of the length between the bulkheads is effective. Where the access openings in both bulkheads have no closing appliances, 50 percent of the length is effective; 75 percent of the length of an open extension beyond the after bulkhead and 50 percent of that beyond the forward bulkhead are effective.

CROSS REFERENCE: For class 1 and class 2 closing appliances, see §§ 45.15–37, 45.15–40.

**§ 45.15–60 Forecastle.**

(a) Where there is an efficient bulkhead and the access openings are fitted with class 1 or class 2 closing appliances, the length to the bulkhead is effective. Where no closing appliances are fitted and the sheer forward of amidships is not less than the standard sheer, 100 per cent of the length of the forecastle forward of 0.1 $L$ from the forward perpendicular is effective; where the sheer forward is half the standard sheer or less, 50 percent of that length is effective; and where the sheer forward is intermediate between the standard and half the standard sheer, an intermediate percentage of that length is effective; 50 per cent of the length of an open extension beyond the bulkhead or beyond 0.1 $L$ from the forward perpendicular is effective.

CROSS REFERENCE: For class 1 and class 2 closing appliances, see §§ 45.15–37, 45.15–40.

**§ 45.15–65 Trunk.**

(a) A trunk or similar structure which does not extend to the sides of the vessel is regarded as efficient, *Provided*, That:

(1) The trunk is at least as strong as a superstructure;

(2) The hatchways are in the trunk deck, and comply with the requirements of §§ 45.10–1—45.10–45, and the width of the trunk deck stringer provides a satisfactory gangway and sufficient lateral stiffness;

(3) A permanent working platform fore and aft fitted with guardrails is provided by the trunk deck, or by detached trunks connected to other superstructures by efficient permanent gangways. On tank barges an efficient lifeline may be accepted in lieu of guardrails;

(4) Ventilators are protected by the trunk, by watertight covers, or by equivalent means;

(5) Open rails are fitted on the weather portions of the freeboard deck in way of the trunk for at least half their length;

(6) The machinery casings are protected by the trunk, by a superstructure of standard height, or by a deckhouse of the same height and of equivalent strength.

(b) Where access openings in poop and bridge bulkheads are fitted with class 1 closing appliances, 100 percent of the length of an efficient trunk reduced in the ratio of its mean breadth to $B$ is added to the effective length of the superstructures. Where the access openings in these bulkheads are not fitted with class 1 closing appliances 90 percent is added.

(c) The standard height of a trunk is the standard height of a bridge.

(d) Where the height of the trunk is less than the standard height of a bridge, the addition is reduced in the ratio of the actual to the standard height; where the height of hatchway coamings on the trunk deck is less than the standard height of coamings (see § 45.15–10), a reduction from the actual height of trunk is to be made which corresponds to the difference between the actual and the standard height of coamings.

**§ 45.15–67 Enclosed superstructure with middle line openings in the deck not provided with permanent means of closing.**

(a) Where there is an enclosed superstructure with one or more middle line openings in the deck not provided with permanent means of closing (see §§ 45.10–1—45.10–45), the effective length of the superstructure is determined as follows:

(1) Where efficient temporary closing appliances are not provided for the middle line deck openings (see §§ 45.15–45), or the breadth of opening is 80 percent or more of the breadth $B_1$ of the superstructure deck at the middle of the opening, the vessel is considered as having an open well in way of each opening, and freeing ports are to be provided in way of this well. The effective length of superstructure between openings is governed by §§ 45.15–50, 45.15–57, 45.15–60.

(2) Where efficient temporary closing appliances are provided for middle line deck openings and the breadth of opening is less than 0.8 $B_1$, the effective length is governed by §§ 45.15–50, 45.15–57, 45.15–60, except that where access openings in 'tween deck bulkheads are closed

by class 2 closing appliances, they are regarded as being closed by class 1 closing appliances in determining the effective length. The total effective length is obtained by adding to the length determined by subparagraph (a) (1) of this section the difference between this length and the length of the vessel modified in the ratio of

$\frac{B_1-b}{B_1}$ where $b$=breadth of deck opening

where

$\frac{B_1-b}{B_1}$ is greater than 0.5 it is taken as 0.5.

**§ 45.15–70 Deductions for superstructures.**

(a) Where the effective length of superstructures is 1.0 *L*, the deduction from the freeboard is 14 inches at 80 feet length of vessel, 34 inches at 280 feet length, and 42 inches at 400 feet length and above; deductions at intermediate lengths are obtained by interpolation. Where the total effective length of superstructures is less than 1.0 *L*, the deduction is a percentage obtained from Table 45.15–70 (a).

TABLE 45.15–70 (a)—TOTAL EFFECTIVE LENGTH OF SUPERSTRUCTURE (E)

| Superstructures | 0 | 0.1*L* | 0.2*L* | 0.3*L* | 0.4*L* | 0.5*L* | Line |
|---|---|---|---|---|---|---|---|
| | *Per-cent* | *Per-cent* | *Per-cent* | *Per-cent* | *Per-cent* | *Per-cent* | |
| All types with forecastle and without detached bridge | [illegible] | 5 | 10 | 15 | 23.5 | 32 | A |
| All types with forecastle and detached bridge [1] | 0 | 6.3 | 12.7 | 19 | 27.5 | [illegible] | [illegible] |

| Superstructures | 0.6*L* | 0.7*L* | 0.8*L* | 0.9*L* | 1.0*L* | Line |
|---|---|---|---|---|---|---|
| | *Per-cent* | *Per-cent* | *Per-cent* | *Per-cent* | *Per-cent* | |
| All types with forecastle and without detached bridge | 46 | 63 | 75.3 | 87.7 | 100 | A |
| All types with forecastle and detached bridge [1] | 46 | [illegible] | 75.3 | 87.7 | [illegible] | [illegible] |

[1] Where the effective length of a detached bridge is less than 0.2*L* the percentages are obtained by interpolation between lines B and A. Where no forecastle is fitted the above percentages are reduced by 5. Percentages for intermediate lengths of superstructures are obtained by interpolation.

**§ 45.15–73 Sheer, general.**

(a) The sheer is measured from the deck at side to a line of reference drawn parallel to the keel through the sheer line at amidships.

(b) In vessels designed to trim by the stern in service, the sheer may be measured in relation to the load line, provided an additional mark is placed at 0.25*L* forward of amidships to indicate the assigned load line. This mark is to be similar to the load line diamond amidships.

(c) In flush deck vessels and in vessels with detached superstructures the sheer is measured at the freeboard deck.

(d) In vessels with topsides of unusual form in which there is a step or break in the topsides, the sheer is considered in relation to the equivalent depth amidships (see § 45.15–10).

(e) In vessels with a superstructure of standard height which extends over the whole length of the freeboard deck, the sheer is measured at the superstructure deck; where the height exceeds the standard, the sheer may be considered in relation to the standard height.

(f) Where a superstructure is intact or access openings in its enclosing bulkheads are fitted with class 1 closing appliances, and the superstructure deck has at least the same sheer as the exposed freeboard deck, the sheer of the enclosed portion of the freeboard deck is not taken into account.

CROSS REFERENCE: For class 1 closing appliances, see § 45.15–37.

**§ 45.15–75 Standard sheer profile.**

(a) The ordinates (in inches) of the standard sheer profile are given in Table 45.15–75(a) where *L* is the number of feet in the length of the vessel.

TABLE 45.15–75 (a)

| Station [1] | Ordinate | Factor |
|---|---|---|
| A. P. | 0.1 *L*+10 | 1 |
| 1/6L from A. P. | 0.0445 *L*+4.45 | [illegible] |
| 1/3L from A. P. | 0.011 *L*+1.1 | 2 |
| Amidships | +0 | 4 |
| 1/3L from F. P. | 0.022 *L*+2.2 | 2 |
| 1/6L from F. P. | 0.089 *L*+8.9 | 4 |
| F. P. | 0.2 *L*+20 | 1 |

[1] A. P.=After end of summer load waterline. F. P.=Fore end of summer load waterline.

**§ 45.15–77 Measurement of variations from standard sheer profile.**

(a) Where the sheer profile differs from the standard, the 7 ordinates of each profile are multiplied by the appropriate factors given in the table of ordinates. The difference between the sums of the respective products, divided by 18, measures the deficiency or excess of sheer. Where the after half of the sheer profile is greater than the standard and the forward half is less than the standard, no credit is allowed for the part in excess and the deficiency only is measured.

(b) Where the forward half of the sheer profile exceeds the standard, and the after portion of the sheer profile is not less than 75 percent of the standard, credit is allowed for the part in excess; where the after part is less than 50 percent of the standard, no credit is given for the excess sheer forward. Where the after sheer is between 50 percent and 75 percent of the standard, intermediate allowances may be granted for excess sheer forward.

**§ 45.15–80 Correction for variations from standard sheer profile.**

(a) The correction for sheer is the deficiency or excess of sheer (see § 45.15–77) multiplied by $0.75-\frac{S}{2L}$ where *S* is the total length of the superstructure, as defined in § 45.15–27.

**§ 45.15–83 Addition for deficiency in sheer.**

(a) Where the sheer is less than the standard, the correction for deficiency in sheer (see § 45.15–80) is added to the freeboard.

**§ 45.15–85 Deduction for excess sheer.**

(a) Where an enclosed superstructure covers 0.1*L* before and 0.1*L* abaft midships, the correction for excess of sheer (see § 45.15–80) is deducted from the freeboard; in vessels with detached superstructures where no enclosed superstructure covers amidships, no deduction is made from the freeboard; where an enclosed superstructure covers less than 0.1*L* before and 0.1*L* abaft amidships, the deduction is obtained by interpolation. The maximum deduction for excess sheer is 1½ inches at 100 feet and increases at the rate of 1½ inches for each additional 100 feet in the length of the vessel.

**§ 45.15–87 Standard round of beam.**

(a) The standard round of beam of the freeboard deck is one-fiftieth of the breadth of the vessel.

**§ 45.15–90 Round of beam correction.**

(a) Where the round of beam of the freeboard deck is greater or less than the standard, the freeboard is decreased or increased respectively by one-fourth of the difference between the actual and the standard round of beam, multiplied by the proportion of the length of the freeboard deck not covered by enclosed superstructures. Twice the standard round of beam is the maximum for which allowance is given.

**§ 45.15–93 Summer freeboard.**

(a) The minimum freeboard in summer is the freeboard derived from the freeboard table after corrections for departures from the standards and after deduction for superstructures. The freeboard measured from the intersection of the upper surface of the freeboard deck with the outer surface of the shell is not to be less than 2 inches.

**§ 45.15–94 Midsummer freeboard.**

(a) In the case of cargo vessels and tankers which comply fully with the provisions of § 45.15–17 as to strength of structure at the deeper draft, the Assigning Authority may permit a reduction in the freeboard for the midsummer season of an amount in inches not exceeding the product of 0.3 multiplied by the summer draft in feet, measured from the top of the keel to the center of the diamond. However, in no case shall the freeboard be less than 2 inches.

**§ 45.15–95 Intermediate and winter freeboard.**

(a) The minimum freeboards for the intermediate and winter seasons is obtained by an addition to the summer freeboard of a distance in inches obtained by multiplying the factors given in Table 45.15–95 (a) by the summer draft in feet measured from the top of the keel to the center of the diamond.

TABLE 45.15–95 (a)

| Length between perpendiculars [1] | Factor for intermediate season | Factor for winter season |
|---|---|---|
| Under 400 feet | 0.25 | 0.50 |
| 450 feet | .25 | .65 |
| 500 feet | .35 | .80 |
| 550 feet and above | .45 | 1.00 |

[1] Factors for intermediate lengths to be obtained by interpolation.

**§ 45.15–96 Salt water freeboard.**

(a) In the case of ships which load in salt water and proceed to fresh water, the minimum freeboards while in salt water for all seasons shall be increased by an amount equal to

$$\frac{\Delta}{417} \text{ inches,}$$

where:

$\Delta$ = displacement in fresh water, in tons of 2,240 pounds at the summer load waterline;

T = tons of 2,240 pounds per inch immersion in fresh water at the summer load waterline.

(1) Where the displacement at the summer load waterline cannot be certified, the increase in freeboard shall be one-fourth of an inch per foot of summer draft measured from the top of the keel.

**§ 45.15–97 Freeboard table for steamers.**

(a) Table 45.15–97(a) gives the basic minimum summer freeboard for steamers which comply with the standards in this part.

TABLE 45.15–97(a)—BASIC MINIMUM SUMMER FREEBOARD FOR STEAMERS

| $L$ (feet) | Freeboard (inches) | $L$ (feet) | Freeboard (inches) | $L$ (feet) | Freeboard (inches) |
|---|---|---|---|---|---|
| 80 | 7.2 | 310 | 42.2 | 540 | 107.4 |
| 90 | 8.0 | 320 | 44.6 | 550 | 110.0 |
| 100 | 8.9 | 330 | 47.0 | 560 | 112.6 |
| 110 | 9.9 | 340 | 49.5 | 570 | 115.1 |
| 120 | 11.0 | 350 | 52.1 | 580 | 117.6 |
| 130 | 12.1 | 360 | 54.8 | 590 | 120.0 |
| 140 | 13.3 | 370 | 57.6 | 600 | 122.3 |
| 150 | 14.5 | 380 | 60.5 | 610 | 124.5 |
| 160 | 15.7 | 390 | 63.4 | 620 | 126.7 |
| 170 | 17.1 | 400 | 66.4 | 630 | 128.8 |
| 180 | 18.5 | 410 | 69.4 | 640 | 130.8 |
| 190 | 19.9 | 420 | 72.4 | 650 | 132.8 |
| 200 | 21.4 | 430 | 75.4 | 660 | 134.7 |
| 210 | 23.0 | 440 | 78.5 | 670 | 136.7 |
| 220 | 24.6 | 450 | 81.5 | 680 | 138.7 |
| 230 | 26.3 | 460 | 84.5 | 690 | 140.7 |
| 240 | 28.1 | 470 | 87.5 | 700 | 142.6 |
| 250 | 29.9 | 480 | 90.5 | 710 | 144.6 |
| 260 | 31.8 | 490 | 93.4 | 720 | 146.5 |
| 270 | 33.8 | 500 | 96.3 | 730 | 148.4 |
| 280 | 35.8 | 510 | 99.1 | 740 | 150.3 |
| 290 | 37.8 | 520 | 101.9 | 750 | 152.1 |
| 300 | 40.0 | 530 | 104.7 | | |

(b) The freeboards at intermediate lengths are obtained by interpolation.

(c) Where $c$ exceeds 0.68, the freeboard is multiplied by the factor

$$\frac{c+0.68}{1.36}$$

(d) Where $D$ exceeds or is less than $\frac{L}{15}$ the freeboard is increased or decreased accordingly, by $\left(D-\frac{L}{15}\right)R$ inches, where $R$ is $\frac{L}{130}$ at lengths less than 390 feet, and 3 at 390 feet length and above, except that the depth to be used in the above correction is not to be taken at less than $L/15$ in vessels below 350 feet in length, nor less than those given in Table 45.15–97 (d), for lengths 350 feet and above. Minimum depths at intermediate lengths are obtained by interpolation.

TABLE 45.15–97 (d)

| $L$ | Minimum depth | $L$ | Minimum depth | $L$ | Minimum depth |
|---|---|---|---|---|---|
| 350 | 23.35 | 450 | 27.65 | 550 | 30.20 |
| 375 | 24.70 | 475 | 28.40 | 575 | 30.70 |
| 400 | 25.80 | 500 | 29.05 | 600 | 31.15 |
| 425 | 26.80 | 525 | 29.65 | 625 | 31.60 |

(1) *Provided, however,* a vessel with an enclosed superstructure covering at least 0.6 $L$ amidships, with a complete trunk, or with a combination of intact partial superstructures and trunk which extends all fore and aft, where $D$ is less than $L/15$, the freeboard is reduced at the above rate. Where the height of superstructures or trunk is less than the standard height, the reduction is in the ratio of the actual to the standard height.

(e) Where the actual depth to the surface of the freeboard deck amidships is greater or less than $D$, the difference between the depths (in inches) is added to or deducted from the freeboard.

## Subpart 45.20—Load Lines for Tankers [2]

**§ 45.20–1 Definition.**

(a) The term "tanker" includes all steamers specially constructed for the carriage of liquid cargoes in bulk.

**§ 45.20–5 Marks on sides.**

(a) The marks on the tanker's sides are to be as shown in Figure 45.05–5(a) and the lines as described in § 45.05–15.

**§ 45.20–10 Construction.**

(a) The structure of the vessel is to be of sufficient strength for the increased draft corresponding to the freeboard assigned.

**§ 45.20–15 Forecastle.**

(a) The vessel is to have a forecastle of which the length is not less than 7 percent of the length of the vessel and the height is not less than the standard height.

[2] The provisions of §§ 45.01–1—45.01–90, inclusive, and §§ 45.05–1—45.15–97, inclusive, shall apply to Great Lakes tankers except as they are modified by §§ 45.20–1—45.20–70, inclusive.

(b) A forecastle is not required in the case of self-propelled barges, tank barges, and cargo barges carrying cargo only on deck.

**§ 45.20–20 Machinery casings.**

(a) The openings in machinery casings on the freeboard deck are to be fitted with steel doors. The casings are to be protected by an enclosed poop or bridge of at least standard height, or by a deckhouse of equal height and of equivalent strength. These conditions may be modified in the case of self-propelled barges. The bulkheads at the ends of these structures are to be of the scantlings required for bridge front bulkheads. All entrances to the structures from the freeboard deck are to be fitted with effective closing appliances, and the sills are to be at least 18 inches above the deck. Exposed machinery casings on the superstructure deck are to be of substantial construction, and all openings in them are to be fitted with steel closing appliances permanently attached to the casings and capable of being closed and secured from both sides; the sills of such openings are to be at least 15 inches above the deck. Fiddley openings are to be as high above the superstructure deck as is reasonable and practicable and are to have strong steel covers permanently attached in their proper positions. Engineroom skylights are to be of substantial construction, fitted with strong glass lights, which may be required to be fitted with steel covers depending on their height above the freeboard deck.

**§ 45.20–25 Gangway.**

(a) An efficiently constructed permanent gangway of sufficient strength for its exposed position is to be fitted fore and aft at the level of the superstructure deck between the poop and midship bridge, and when crew are berthed forward from the bridge to the forecastle, or other equivalent means of access may be provided to carry out the purpose of the gangway, such as passage below deck.

(b) On towed tank barges a wire cable arranged and equipped to facilitate safe communication between both ends of the vessel at all times may be accepted in lieu of a permanent gangway.

**§ 45.20–30 Protection of crew, access to machinery space, etc.**

(a) Safe and satisfactory access from the gangway level to the quarters of the crew, the machinery space, and all other parts used in the necessary work of the vessel is to be available at all times. This section does not apply to pumprooms entered from the freeboard deck, when fitted with class 1 closing appliances. Deckhouses for the accommodation of the crew, pilothouses, etc., on the freeboard deck are to be of steel efficiently constructed and provided with port lights fitted with steel deadlights.

**§ 45.20–35 Hatchways.**

(a) All hatchways on the freeboard deck and on the deck of expansion trunks are to be closed watertight by efficient steel covers.

### § 45.20–40 Ventilators.

(a) Ventilators to spaces below the freeboard deck are to be of ample strength or are to be protected by superstructures or equally efficient means.

### § 45.20–45 Freeing arrangements.

(a) Vessels with bulwarks are to have open rails fitted for at least half the length of the exposed portion of the weather deck or other effective freeing arrangements. The upper edge of the sheer strake is to be kept as low as practicable and preferably not higher than the upper edge of the gunwale bar.

(b) Where superstructures are connected by trunks, open rails are to be fitted for the whole length of the weather portions of the freeboard deck.

### § 45.20–50 Plans.

(a) Plans showing proposed fittings and arrangements are to be submitted to the assigning authority for approval.

### § 45.20–55 Computation of freeboard.

(a) When the assigning authority is satisfied that the foregoing requirements are fulfilled, the summer freeboard may be computed from the table for tankers; all corrections, except those for flush-deck steamers, detached superstructures, and excess sheer, are to be made in accordance with §§ 45.15–1—45.20–1.

### § 45.20–60 Deductions for detached superstructures.

(a) When the total effective length of superstructure is less than 1.0 *L*, the deduction is a percentage of that for a superstructure of length 1.0 *L*, and is obtained from Table 45.20–60 (a).

TABLE 45.20-60 (a)—TOTAL EFFECTIVE LENGTH OF SUPERSTRUCTURES

| | 0 | 0.1*L* | 0.2*L* | 0.3*L* | 0.4*L* | 0.5*L* | 0.6*L* | 0.7*L* | 0.8*L* | 0.9*L* | 1.0*L* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| All types | *Percent* 0 | *Percent* 7 | *Percent* 14 | *Percent* 21 | *Percent* 31 | *Percent* 41 | *Percent* 52 | *Percent* 63 | *Percent* 75.3 | *Percent* 87.7 | *Percent* 100 |

### § 45.20–65 Deduction for excess sheer.

(a) Where the sheer is greater than the standard, the correction for excess sheer (see § 45.15–80) is deducted from the freeboard for all tankers. Section 45.15–85 does not apply except that the maximum deduction for excess sheer is 1½ inches at 100 feet and increases at the rate of 1½ inches for each additional 100 feet in the length of the vessel.

### § 45.20–70 Freeboard table for tankers.

(a) Table 45.20–70 (a) gives the basic minimum summer freeboard for tankers which comply with the standards in this part.

TABLE 45.20-70 (a)—BASIC MINIMUM SUMMER FREEBOARD FOR TANKERS

| *L* (feet) | Freeboard | *L* (feet) | Freeboard | *L* (feet) | Freeboard |
|---|---|---|---|---|---|
| | *Inches* | | *Inches* | | *Inches* |
| 80 | 6.4 | 220 | 22.8 | 360 | 48.5 |
| 90 | 7.2 | 230 | 24.3 | 370 | 50.6 |
| 100 | 8.1 | 240 | 25.9 | 380 | 52.7 |
| 110 | 9.1 | 250 | 27.5 | 390 | 54.9 |
| 120 | 10.1 | 260 | 29.2 | 400 | 57.1 |
| 130 | 11.1 | 270 | 30.9 | 410 | 59.4 |
| 140 | 12.2 | 280 | 32.7 | 420 | 61.7 |
| 150 | 13.3 | 290 | 34.5 | 430 | 64.1 |
| 160 | 14.5 | 300 | 36.4 | 440 | 66.5 |
| 170 | 15.8 | 310 | 38.3 | 450 | 69.0 |
| 180 | 17.1 | 320 | 40.2 | 460 | 71.5 |
| 190 | 18.5 | 330 | 42.2 | [1] | [1] |
| 200 | 19.9 | 340 | 44.3 | | |
| 210 | 21.3 | 350 | 46.4 | | |

[1] Tankers above 460 feet in length to be specially considered, and the assigned freeboards are to be approved by the Commandant, U. S. Coast Guard, before issuance of certificate.

## Subpart 45.25—Fees and Form of Certificate

### § 45.25–1 Fees.

(a) Fees payable by owners will be charged for the assignment of load line, renewal of load line certificates, and annual load line inspection, in accordance with the regulations set forth in § 43.40–5 of this subchapter.

### § 45.25–5 Form of load line certificate.

LOAD LINE CERTIFICATE FOR THE GREAT LAKES

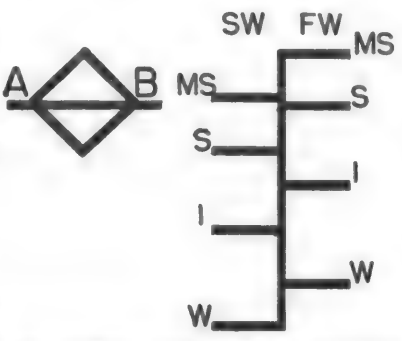
[SEAL]

Issued under the authority of the Commandant, U.S. Coast Guard, United States of America, under the provisions of the act of August 27, 1935, as amended, to establish load lines for American merchant vessels of 150 gross tons or over engaged in trade on the Great Lakes of North America.

Ship _____
Certificate No. _____
Official No. _____
Gross tonnage _____
Port of registry _____

| FREEBOARD FROM DECK LINE | | LOAD LINE |
|---|---|---|
| Midsummer _____ | MS | _____ above S |
| Summer _____ | S | Upper edge of line through center of diamond. |
| Intermediate _____ | I | _____ below S |
| Winter _____ | W | _____ below S |

Increase for salt water for all freeboards _____ inches.




The upper edge of the deck line from which these freeboards are measured is _____ inches above the top of the _____ deck at side.

This is to certify that this ship has been surveyed and the freeboards and load lines shown above have been found to be correctly marked upon the vessel in manner and location as provided by the load line regulations of the Commandant, U.S. Coast Guard, applicable to the Great Lakes.

This certificate[1] remains in force until _____. Issued at _____ on the _____ day of _____ 19___. (Here follows the signature, seal, if any, and the name of the authority issuing the certificate.)

NOTES: (1) In accordance with the Great Lakes Load Line Regulations the diamond and lines must be permanently marked by center punch marks or cutting. The "MS" load line shall be assigned only to those particular vessels that qualify under the regulations.

(2) The "SW" marks need only be assigned to Great Lakes vessels loading in salt water of the St. Lawrence River west of a straight line from Cap de Rosiers to West Point Anticosti Island, and west of a line along longitude 63 degrees west from Anticosti Island to the north shore of the St. Lawrence River. In such cases these limits shall be indicated on the certificate.

(3) The load line assignment given by this certificate necessarily assumes that the nature and stowage of cargo, ballast, etc., are such as to secure sufficient stability for the vessel. Accordingly, it is the owner's responsibility to furnish the Master of the vessel with stability information and instructions when this is necessary to maintenance of sufficient stability.

(On the reverse side of the load line certificate, or on a separate sheet attached and forming part of the certificate, provision is to be made for annual inspection and renewal endorsements.)

[1] Upon the expiration of the certificate, renewal must be obtained as provided by the Great Lakes Load Line Regulations and the certificate so endorsed.

## PART 46—SUBDIVISION LOAD LINES FOR PASSENGER VESSELS

### Subpart 46.01—Authority and Purpose

Sec.
46.01–1 Purpose.
46.01–5 Authority.
46.01–10 Responsibility for administration.
46.01–15 Application of regulations.
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### Subpart 46.05—Definitions Used in This Part

46.05–1 Passenger vessel.
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46.05–15 Coastwise voyages.
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46.05–25 New passenger vessel.
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### Subpart 46.10—Administration

46.10–1 Relaxation from regulations.
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46.10–10 Marks to indicate subdivision load lines.
46.10–15 Survey for the establishment and renewal of subdivision load line marks.
46.10–20 Application for the assignment and renewal of subdivision load lines.
46.10–25 Equivalents.
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46.10–40 Nonsubmergence subdivision load line (Great Lakes).
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46.10–50 Drills and inspections.
46.10–55 Logbook entries.

Sec.
46.10–60 Control.
46.10–65 Construction.
46.10–70 Plans and inspections of new and converted vessels.

Subpart 46.15—Subdivision Load Lines for Passenger Vessels Engaged in Foreign, Coastwise, and Great Lakes Voyages

46.15–1 Procedure for determination of subdivision load line.
46.15–5 Engineering requirements.
46.15–10 Subdivision load lines.

AUTHORITY: The provisions of this Part 46 issued under sec. 2, 45 Stat. 1493, as amended, sec. 2, 49 Stat. 888, as amended; 46 U.S.C. 85a, 88a. Interpret or apply R.S. 4490, as amended, sec. 3, 24 Stat. 129, as amended, 41 Stat. 305, as amended, sec. 5, 49 Stat. 1384, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 68 Stat. 675; 46 U.S.C. 482, 483, 363, 369, 367, 1333, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–48, Oct. 19, 1962, 27 F.R. 10504.

## Subpart 46.01—Authority and Purpose

### § 46.01–1 Purpose.

(a) The purpose of the regulations in this part is to set forth uniform minimum requirements applicable to passenger vessels required to have subdivision load lines. These requirements deal with the following:

(1) Load line requirements applicable before a passenger vessel will be marked with and certificated as to subdivision load lines.

(2) Assigning, marking, and recording of subdivision load lines.

(3) Administration of subdivision load lines.

(4) Application of requirements to passenger vessels.

### § 46.01–5 Authority.

(a) The regulations regarding subdivision and subdivision load lines interpret or apply Title 46, U.S. Code, sections 85a, 88a, 363, 367, 369, 482, 483, and 1333, and Title 50, U.S. Code, section 198.

(b) The International Load Line Convention, 1930, and the applicable International Convention for Safety of Life at Sea, also establish minimum requirements for load lines and subdivision.

### § 46.01–10 Responsibility for administration.

(a) Under the general direction and supervision of the Secretary of the Treasury, the Commandant of the United States Coast Guard is delegated the responsibility and authority for the administration of load line requirements and to determine the position and to assure the correct marking of subdivision load lines on all passenger vessels subject to the applicable International Convention for Safety of Life at Sea, or the Act of March 2, 1929, as amended (46 U.S.C. 85–85g), or the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88i).

### § 46.01–15 Application of regulations.

(a) The regulations in this part establish subdivision load lines required on passenger vessels engaged in foreign voyages, as well as on passenger vessels of 150 gross tons or over engaged in coastwise or Great Lakes voyages.

(b) When engaged in voyages subject to this part, no passenger vessel required to be marked with subdivision load lines shall depart from or arrive at any port or place under the jurisdiction of the United States, nor shall such United States vessel operate on the high seas nor the Great Lakes, unless such vessel has been marked with subdivision load lines in accordance with the regulations in this part, has on board a valid certificate certifying to the correctness of the location of such subdivision load line marks, and is otherwise in compliance with the applicable requirements of law and regulations in this part.

(c) No passenger vessel of the United States of 150 gross tons or over and subject to the Coastwise Load Line Act, 1935, as amended, shall engage in coastwise voyages or voyages on the Great Lakes unless such vessel has been marked with subdivision load lines in accordance with the regulations in this part and has on board a valid certificate certifying to the correctness of the location of such subdivision load line marks.

(d) No foreign passenger vessel belonging to a country that has ratified or acceded to the applicable International Convention for Safety of Life at Sea shall arrive or depart from any port or place under the jurisdiction of the United States, and no foreign passenger vessel of 150 gross tons or over subject to the Act of March 2, 1929, as amended (46 U.S.C. 85–85g), or the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88i), shall arrive or depart from any port or place under the jurisdiction of the United States, including ports on the Great Lakes, unless such passenger vessel has been marked with subdivision load lines in accordance with the regulations in this part and has on board a valid certificate certifying to the correctness of the location of such subdivision load line marks.

(e) Subdivision load lines shall be marked on both sides of passenger vessels where determined and in a manner described in Subpart 46.15 as applicable to the vessel's service. The subdivision load line certificates shall be in accordance with §§ 46.10–30 and 46.10–35.

### § 46.01–20 Penalties for violations.

(a) Penalties for violations of the regulations in this part by passenger vessels of the United States engaged in foreign voyages shall be in accordance with those laws which require the inspection and certification of the vessel. In addition, for passenger vessels of 150 gross tons or over and subject to either the Act of March 2, 1929, as amended (46 U.S.C. 85–85g), or the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88i), which engage in voyages described in § 43.01–1 or 45.01–1, the penalties for violations of the regulations in this part shall be those set forth in the load line act applicable to the vessel.

(b) For a further description of the actions which may be taken see § 43.01–13 of this subchapter. The procedures governing the assessment, collection, remission and mitigation of any monetary penalty imposed for a violation of a law or the regulations prescribed thereunder in this part, as well as the appeal procedures followed, are in Subpart 2.50 of Part 2 of Subchapter A (Procedures Applicable to the Public) of this chapter.

## Subpart 46.05—Definitions Used in This Part

### § 46.05–1 Passenger vessel.

(a) For the purpose of the regulations in this part, a vessel is a passenger vessel if:

(1) Engaged on an international voyage by sea, it carries or is authorized to carry more than 12 passengers; or,

(2) Engaged on a coastwise voyage by sea or a voyage on the Great Lakes, it carries or is authorized to carry more than 16 persons in addition to the crew.

### § 46.05–10 Foreign voyage.

(a) A foreign voyage for the purpose of marking passenger vessels with subdivision load lines is a voyage by sea between a port under the jurisdiction of the United States and a port of a foreign country, its colonies, territories, or protectorates, or conversely (a voyage exclusively on the Great Lakes excepted).

### § 46.05–15 Coastwise voyages.

(a) A coastwise voyage by sea, for the purpose of marking passenger vessels with subdivision load lines, is a voyage in which a vessel in the usual course of her employment proceeds from one port or place in the United States to another port or place in the United States or from a port or place in a possession to another port or place in the same possession, and passes outside the line dividing inland waters from the high seas (a voyage exclusively on the Great Lakes excepted), as well as a voyage in which a vessel proceeds from a port or place in the United States or her possessions and passes outside the line dividing inland waters from the high seas and navigates on the high seas, and then returns to the same port or place.

### § 46.05–20 Great Lakes voyage.

A Great Lakes voyage is any voyage from a United States port or place on the Great Lakes to another United States port or place on the Great Lakes or to a Canadian port or place on the Great Lakes, or conversely.

### § 46.05–25 New passenger vessel.

A new passenger vessel is a vessel whose keel was laid or was a vessel converted into a passenger vessel on or after November 19, 1952.

### § 46.05–30 Existing passenger vessel.

An existing passenger vessel in respect to its voyage is any passenger vessel that is not a new passenger vessel as defined in § 46.05–25.

## Subpart 46.10—Administration

**§ 46.10–1 Relaxation from regulations.**

(a) New passenger vessels making foreign voyages by sea shall comply with the requirements in this part. An existing passenger vessel engaged in foreign voyages by sea may be permitted relaxation from the requirements of this part if, in the opinion of the Commandant, U. S. Coast Guard, such requirements are unreasonable or impracticable.

(b) A new passenger vessel making coastwise voyages by sea or making Great Lakes voyages shall comply with the requirements in this part. An existing passenger vessel making coastwise voyages by sea or Great Lakes voyages may be permitted relaxation from the requirements of this part if, in the opinion of the Commandant, U. S., Coast Guard, such requirements are unreasonable or impracticable.

**§ 46.10–5 Load line requirements for subdivision.**

(a) The load line requirements of Parts 43, 44, 45 of this subchapter as applicable to the passenger vessel and her service, shall be complied with before a passenger vessel will be marked with and certificated as to subdivision load lines.

**§ 46.10–10 Marks to indicate subdivision load lines.**

(a) Marks to indicate the maximum mean draft to which a passenger vessel may be lawfully submerged shall be permanently marked on each side of the passenger vessel in the form, manner, and location provided in this part.

(b) The Commandant, U.S. Coast Guard, shall determine the position of the subdivision load lines by the application of the requirements contained in this part and Parts 73 and 74 of Subchapter H (Passenger Vessels) of this chapter. The correct marking of subdivision load lines on passenger vessels shall be certified to by the American Bureau of Shipping as a classification society approved by the Commandant for such purpose.

(c) Certificates certifying to the correctness of subdivision load line marks shall not be furnished until it is determined that the marks have been correctly placed upon the passenger vessel.

(d) In the case of passenger vessels that are required by the International Convention for Safety of Life at Sea to have on board a safety certificate, the certification of subdivision load line marks shall be made by letter to the Commandant, U. S. Coast Guard, Washington, D.C., 20226.

**§ 46.10–15 Survey for the establishment and renewal of subdivision load line marks.**

(a) Every passenger vessel to be marked with and certificated for subdivision load lines must comply with the requirements as set forth in Subchapter H (Passenger Vessels) of this chapter for ocean, coastwise, and Great Lakes service as applicable to the particular vessel and the service in which she is to be employed.

(b) Every passenger vessel marked with a subdivision load line shall be subjected to the surveys specified in this paragraph. The details of the surveys or inspections indicated in subparagraphs (1) through (3) of this paragraph shall be as set forth in the applicable sections of Part 71 of Subchapter H (Passenger Vessels) of this chapter.

(1) A survey before the vessel is put in service.

(2) A periodical survey once every 12 months.

(3) Additional surveys as occasion arises.

(4) Surveys required by Parts 43, 44, or 45 of this subchapter.

**§ 46.10–20 Application for the assignment and renewal of subdivision load lines.**

(a) Application for assignment and renewal of subdivision load lines and certification thereof shall be made in writing to the Commandant, U.S. Coast Guard, Washington, D.C., 20226.

**§ 46.10–25 Equivalents.**

(a) Where in the regulations in this part it is provided that a particular fitting, appliance, apparatus, or type thereof, shall be fitted or carried in a vessel engaged on foreign voyages by sea or that any particular arrangement shall be adopted, there may be substituted any other fitting or appliance or type thereof or any other arrangement provided that the Commandant, U.S. Coast Guard, shall have been satisfied by suitable trials that the fitting, appliance, or apparatus, or type thereof, or that the arrangement substituted is at least as effective as that specified in this part.

(b) Where, in the application of the regulations in this part to passenger vessels engaged in coastwise voyages by sea and on Great Lakes voyages, it is desired to substitute other construction, arrangement, fitting, or appliance, or type thereof, such substitution may be made if approved by the Commandant, U. S. Coast Guard, provided the degree of safety provided by this part is obtained.

**§ 46.10–30 Subdivision load line certificates.**

(a) Passenger vessels engaged in foreign voyages by sea shall have their subdivision load lines certificated on the safety certificate required by the International Convention for Safety of Life at Sea, 1948. Safety certificates shall be issued by the Commandant, U. S. Coast Guard, Washington, D.C., 20226, for a period not to exceed one year. These vessels will also be provided with the load line certificate required by Part 43 of this subchapter, the minimum freeboard shown thereon to be not less than the minimum freeboard corresponding to the principal passenger condition. The fact that they are subdivision load lines is to be noted on the load line certificate.

(b) Passenger vessels engaged on coastwise voyages by sea or Great Lakes voyages shall have the position of their subdivision load lines recorded on a load line certificate in the form required by Parts 43 or 45 of this subchapter. The fact that they are subdivision load lines is to be noted on the load line certificate.

(c) A note shall be added to the load line certificate below the signature of the assigning authority in the following form:

> The bulkhead deck used for determining the position of the subdivision load lines certified above is _____ (here described bulkhead deck).

(d) Annual inspections of passenger vessels shall be as required by §§ 43.01–55 and 46.10–15 of this subchapter and renewal of passenger vessels' load line certificates shall be as required by § 43.01–75.

(e) Each new passenger vessel which receives its first load line certificate shall also be provided with a copy of the load line survey report as required by §§ 43.01–40 or 45.01–30 of this subchapter.

**§ 46.10–35 Validity of subdivision load line certificates.**

(a) Subdivision load line certificates issued to passenger vessels shall only be valid during the time for which the certificates are issued.

(b) If, due to any cause, the conditions as required by this part are changed, or the regulations in this part are not carried out, the load line certificate may be cancelled and the load lines considered nonexistent: *Provided*, That if the conditions causing the cancellation of the certificate are satisfactorily corrected, the load line certificate shall be reinstated for the remainder of its term.

(c) A valid subdivision load line certificate for foreign voyages by sea shall be valid for coastwise voyages by sea and Great Lakes voyages. A valid subdivision load line certificate for coastwise voyages by sea shall be valid for Great Lakes voyages but not for foreign voyages by sea. A valid subdivision load line certificate for Great Lakes voyages shall not be valid for foreign or coastwise voyages by sea.

**§ 46.10–40 Nonsubmergence subdivision load line (Great Lakes).**

(a) Passenger vessels on the Great Lakes of 150 gross tons or over shall not submerge the subdivision load line applicable to the voyage.

**§ 46.10–45 Nonsubmergence subdivision load lines in salt water.**

(a) Passenger vessels required to be marked with subdivision load lines, engaged on foreign and coastwise voyages other than the Great Lakes voyages, shall not submerge in salt water the subdivision load line applicable to the voyage. Passenger vessels engaged on ocean foreign or coastwise voyages may be marked with fresh water load lines. A passenger vessel on foreign or coastwise voyages (except Great Lakes voyages) may have an allowance made for the degree of brackishness of the water in which the vessel is floating but not for the weight of fuel, water, etc., required for consumption between the point of departure and the open sea, and no allowance is to be made for bilge or ballast

water that may be in the passenger vessel at the time of departure.

**§ 46.10–50 Drills and inspections.**

(a) For the required drills and inspections to be conducted on passenger vessels, see Subpart 78.17 of Subchapter H (Passenger Vessels) of this chapter.

**§ 46.10–55 Log book entries.**

(a) For required logbook entries to be made on passenger vessels, see Subpart 78.17 of Subchapter H (Passenger Vessels) of this chapter.

**§ 46.10–60 Control.**

(a) The Collector of Customs or the Coast Guard District Commander may detain a passenger vessel for a survey if there is reason to believe that such a vessel is proceeding on her journey in excess of the draft allowed by the regulations in this part as indicated by the vessel's load lines certified on the safety certificate, load line certificate, or otherwise. The Coast Guard District Commander may detain a passenger vessel if it is so loaded as to be manifestly unsafe to proceed to sea.

(b) When passenger vessels are subject to the Act of March 2, 1929 (46 U.S.C. 85–85g), the duties and responsibilities of the Collector of Customs or the Coast Guard District Commander and the procedures followed shall be the same as those stated in § 43.01–97 of this chapter.

(c) When passenger vessels are subject to the Coastwise Load Line Act, 1935, as amended (46 U.S.C. 88–88i), the duties and responsibilities of the Collector of Customs or the Coast Guard District Commander and the procedures followed shall be the same as those stated in § 43.01–97 or 45.01–85 of this subchapter, as applicable.

**§ 46.10–65 Construction.**

(a) The watertight subdivision of every passenger vessel shall be as efficient as possible, having regard to its intended service. This principle is given effect by the requirements of Part 73 of Subchapter H (Passenger Vessels) of this chapter which provide for variations in the standard of subdivision according to the length of the vessel and the degree to which the vessel approaches the exclusive passenger type, the highest standard being required in vessels of the greatest length engaged primarily in the carriage of passengers.

(b) Passenger vessels engaged in foreign voyages by sea or coastwise voyages by sea or voyages on the Great Lakes, to be marked with subdivision load lines shall comply with the requirements in this part.

**§ 46.10–70 Plans and inspections of new and converted vessels.**

(a) Plans for a new passenger vessel or a vessel to be converted to a passenger vessel shall be submitted to the Commandant as required by Subpart 71.65 of Subchapter H (Passenger Vessels) of this chapter.

(b) Inspections shall be made during the construction or conversion of the vessel as required by Subpart 71.20 of Subchapter H (Passenger Vessels) of this chapter.

(c) Upon completion of the construction or conversion of a passenger vessel, a stability test shall be performed and stability information shall be supplied to the operator as required by Part 74 of Subchapter H (Passenger Vessels) of this chapter.

## Subpart 46.15—Subdivision Load Lines for Passenger Vessels Engaged in Foreign, Coastwise, and Great Lakes Voyages

**§ 46.15–1 Procedure for determination of subdivision load line.**

(a) The procedure for the determination of the subdivision load line as well as special construction features of the vessel shall be as set forth in Subpart 72.01 and Parts 73 and 74 of Subchapter H (Passenger Vessels) of this chapter.

**§ 46.15–5 Engineering requirements.**

(a) Bilge and ballast systems, piping, inlets and discharges, ash chutes, astern power, and auxiliary steering shall be in accordance with the provisions of Subchapter F (Marine Engineering) of this chapter.

**§ 46.15–10 Subdivision load lines.**

(a) Subdivision load lines shall be located by measuring vertically down from the deck line required by Part 43 of this subchapter.

(b) The length, width, and manner of marking the lines shall be as provided in Subpart 43.05 of this subchapter.

(c) No subdivision load line is to be placed so that the freeboard is reduced from that determined by the highest seasonal mark permitted by Part 43.

(d) When the highest subdivision load line is located on a vessel used as a passenger vessel in a position between the highest and lowest seasonal load line marks, the seasonal load line marks above the subdivision load line will be omitted and those below will be marked.

(e) When the freeboard from the highest subdivision load line on a vessel used as a passenger vessel is greater than the freeboard from the lowest load line permitted by Part 43 of this subchapter, the load lines required by Part 43 of this subchapter shall be omitted and the disk with its horizontal line located in line with the highest subdivision load line.

(f) One fresh water line shall be marked. When a subdivision and a normal load line are combined, the normal fresh water line only shall be used unless the position of the subdivision load line is such that confusion will result, in which case a subdivision fresh water line may be used, marked $FC_1$ and the normal fresh water line omitted.

(g) Subdivision load lines shall be aft of the vertical line. The vertical line shall be extended as necessary to connect the lowest and highest load lines marked on the vessel.

(h) When a vessel has spaces used for cargo and passengers alternatively so that the position of the subdivision load line varies with the service, subdivision load lines for the principal passenger condition shall be marked and denoted by $C_1$ and the alternative conditions marked and denoted by $C_2$, $C_3$, etc. The position of each load line and the conditions under which a particular load line is applicable shall be noted in the certificate.

(i) The principal passenger condition for a vessel having spaces used for passengers and cargo alternatively is the condition where only those spaces appropriated exclusively to passengers are taken into consideration for determination of the subdivision load line.

(j) For Great Lakes vessels, references to Part 43 shall read Part 45 and a "diamond" shall be substituted for the "disk". No "fresh water" line will be marked.

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SUBCHAPTER F—MARINE ENGINEERING

# PART 50—GENERAL PROVISIONS

**Subpart 50.01—Basis and Purpose**

Sec.


50.01–1 Authority.
50.01–5 Assignment of functions.
50.01–10 Purpose of regulations.
50.01–15 Application of regulations.


**Subpart 50.10—Definition of Terms Used in This Subchapter**


50.10–1 Commandant.
50.10–5 Coast Guard District Commander.
50.10–10 Officer in Charge, Marine Inspection.
50.10–15 Marine inspector or inspector.
50.10–20 Requirements.
50.10–25 Headquarters.


AUTHORITY: The provisions of this Part 50 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426–4431, as amended, 4433, as amended, 4434, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404–409, 411, 412, 435, 481, 489, 366, 395, 363, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857.

## Subpart 50.01—Basis and Purpose

**§ 50.01–1 Authority.**

(a) The authority to prescribe regulations generally is set forth in R.S. 4405 and 4462, as amended (46 U.S.C. 375 and 416), as well as in other provisions of Title 52 of the Revised Statutes and acts amendatory thereof or supplemental thereto. Under the provisions of R.S. 4403, as amended (46 U.S.C. 372), the Commandant, United States Coast Guard superintends the administration of the vessel inspection laws and is required to produce a correct and uniform administration of the inspection laws, rules, and regulations.

**§ 50.01–5 Assignment of functions.**

By Reorganization Plan No. 3 of 1946, effective July 16, 1946, 3 CFR, 1946 Supp.,

the marine inspection functions of the former Bureau of Marine Inspection and Navigation and its officers and employees were transferred to the Commandant, United States Coast Guard. By Reorganization Plan No. 26 of 1950, effective July 31, 1950, 3 CFR, 1950 Supp., p. 178, the functions formerly vested in the Commandant, United States Coast Guard were transferred to the Secretary of the Treasury with certain specific exceptions. The Secretary of the Treasury by an order dated July 31, 1950 (15 F. R. 6521), delegated to the Commandant the functions formerly performed by him under Reorganization Plan No. 3 of 1946.

**§ 50.01–10 Purpose of regulations.**

The purpose of the regulations in this subchapter is to set forth uniform minimum requirements for marine engineering in accordance with the intent of Title 52 of the Revised Statutes and acts amendatory thereof or supplemental thereto, as well as to implement various International Conventions for Safety of Life at Sea and other treaties which affect the merchant marine. The regulations are necessary to carry out the provisions of law affecting inspected vessels and such regulations have the force of law.

**§ 50.01–15 Application of regulations.**

(a) The regulations in this subchapter contain specifications and requirements for materials, design, construction, installation, and inspection of machinery, boilers, unfired pressure vessels, safety valves and appurtenances, including piping systems, upon the strength and efficiency of which safety of life is dependent.

(b) The regulations in this subchapter apply to installations contracted for or built on or after July 1, 1935. The regulations in Subchapter G (Marine Engineering Installations Contracted for Prior to July 1, 1935) of this chapter apply only to installations contracted for or built prior to July 1, 1935.

(c) The regulations in this subchapter are not retroactive in effect, except as provided in paragraph (d) of this section or if specifically provided for in the regulation at the time it is amended or added. The regulations amended or added subsequent to July 1, 1935, are applicable to installations contracted for or built on or after the effective date of such regulations. For the purpose of recalculating the maximum allowable pressure of boilers, unfired pressure vessels and piping under the provisions of § 61.20–15 (f), the formulas found in this subchapter may be used for boilers, unfired pressure vessels and piping: *Provided*, That such recalculation shall not permit a higher pressure than that originally allowed by the regulations in effect at the time such work was contracted for or built.

(d) Where existing vessels are reboilered, the mountings and attachments shall be renewed in accordance with the regulations in this subchapter in effect at the time such work is contracted for. The existing steam piping shall be examined as provided for in § 55.07–5, and if found to be in good condition and complying with the minimum thickness required for the pressure and temperature design conditions at the time of installation of the new boiler, the piping may be continued in service.

(e) Items of equipment previously approved by the Commandant but not complying with the latest specifications and which are in good and serviceable condition may be continued in use until replacement is necessary.

## Subpart 50.10—Definition of Terms Used in This Subchapter

**§ 50.10–1 Commandant.**

The term "Commandant means the Commandant of the Coast Guard.

**§ 50.10–5 Coast Guard District Commander.**

The term "Coast Guard District Commander" means an officer of the Coast Guard designated as such by the Commandant to command all Coast Guard activities within his district, which include the inspections, enforcement, and administration of Title 52, Revised Statutes, and acts amendatory thereof or supplemental thereto, and rules and regulations thereunder.

**§ 50.10–10 Officer in Charge, Marine Inspection.**

The term "Officer in Charge, Marine Inspection," means any person from the civilian or military branch of the Coast Guard designated as such by the Commandant and who under the superintendence and direction of the Coast Guard District Commander is in charge of an inspection district for the performance of duties with respect to the inspections, enforcement, and administration of Title 52, Revised Statutes, and acts amendatory thereof or supplemental thereto, and rules and regulations thereunder.

**§ 50.10–15 Marine inspector or inspector.**

The terms "marine inspector" or "inspector" mean any person from the civilian or military branch of the Coast Guard assigned under the superintendence and direction of an Officer in Charge, Marine Inspection, or any other person as may be designated for the performance of duties with respect to the inspections, enforcement, and the administration of Title 52, Revised Statutes, and acts amendatory thereof or supplemental thereto, and rules and regulations thereunder.

**§ 50.10–20 Requirements.**

The term "requirements" refers to process of manufacture, characteristic, physical and chemical properties, tests, workmanship, and finish of materials.

**§ 50.10–25 Headquarters.**

The term "headquarters" means the office of the Commandant, United States Coast Guard, Washington, D.C., 20226.

# PART 51—MATERIALS

## Subpart 51.01—General

Sec.


51.01–1 Statutory requirements.
51.01–5 Basic information requirements.
51.01–10 General classification of materials.
51.01–15 Inspection and testing of class A material.
51.01–20 Chemical analyses.
51.01–25 Certification of class B material.
51.01–30 Tension tests.
51.01–40 Retests.
51.01–45 Rejections.
51.01–50 Appeals.
51.01–55 Process of steel manufacture.
51.01–60 Stamping plates and specimens.
51.01–65 Stock plates.
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## Subpart 51.04—Marine Boiler Steel Plate


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## Subpart 51.07—Staybolt and Rivet Steel


51.07–1 Scope.


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51.10–1 Scope.
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51.13–1 Scope.


## Subpart 51.22—Flange and Firebox Steel Plates


51.22–1 Scope.


## Subpart 51.23—Corrosion Resisting Steel Plate, Sheet and Strip for Unfired Pressure Vessels


51.23–1 Scope.


## Subpart 51.24—Materials for Low Temperature Service


51.24–1 Scope.


## Subpart 51.25—Carbon and Alloy-Steel and Wrought Iron Tubes


51.25–1 Scope.


## Subpart 51.34—Carbon and Alloy-Steel and Wrought Iron Pipe


51.34–1 Scope.


## Subpart 51.46—Steel Forgings


51.46–1 Scope.
51.46–5 Hydrostatic tests.


## Subpart 51.49—Carbon and Alloy-Steel Bolting and Nut Material


51.49–1 Scope.


## Subpart 51.58—Steel Castings


51.58–1 Scope.
51.58–5 Hydrostatic tests.


## Subpart 51.61—Iron Castings


51.61–1 Scope.
51.61–5 Hydrostatic tests.
51.61–10 Markings.

Subpart 51.67—Copper and Copper-Alloy Plate

Sec.
51.67–1 Scope.

Subpart 51.70—Seamless Copper and Copper-Alloy Pipe

51.70–1 Scope.

Subpart 51.73—Seamless Copper and Copper-Alloy Tubes

51.73–1 Scope.

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51.76–1 Scope.
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Subpart 51.79—Aluminum-Alloy Plates and Sheets

51.79–1 Scope.

Subpart 51.80—Aluminum-Alloy Pipe and Tubes

51.80–1 Scope.

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Subpart 51.82—Aluminum-Alloy Bars, Rods, and Shapes

51.82–1 Scope.

Subpart 51.85—Nickel-Alloy Plates and Sheets

51.85–1 Scope.

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51.86–1 Scope.

Subpart 51.90—Rigid Poly (Vinyl Chloride) (PVC) Materials

51.90–1 Scope.

AUTHORITY: The provisions of this Part 51 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426–4431, as amended, 4433, as amended, 4434, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404–409, 411, 412, 435, 481, 489, 366, 395, 363, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857.

## Subpart 51.01—General

### § 51.01–1 Statutory requirements.

(a) Plates, bars, and shapes used as pressure parts of boilers intended for marine service shall be tested, inspected, and stamped by an inspector in accordance with the requirements of Title 52 of the Revised Statutes of the United States.

(b) Material used for pressure parts in the construction of pressure vessels other than boilers shall conform to the requirements of this part.

### § 51.01–5 Basic information required.

When ordering material for the construction of boilers or unfired pressure vessels to be installed on vessels subject to the inspection of the Coast Guard, boiler manufacturers shall, as far as practicable, furnish the following information to the manufacturer of the material and to the Officer in Charge, Marine Inspection, in the district where the boiler or unfired pressure vessel is to be fabricated:

(a) Name and location of manufacturer's works.

(b) Type and size of boiler or unfired pressure vessel.

(c) Manufacturer's serial or shop number.

(d) Design pressure.

(e) Name of shipyard and hull number.

(f) Vessel's name.

### § 51.01–10 General classification of materials.

(a) The materials to be used in the construction of boilers and unfired pressure vessels, piping, valves, fittings, and appurtenances below listed shall be of three general classes of which classes A and B shall be used for pressure parts and class C may be used for other parts as specified.

Class A: Tested materials manufactured under the supervision of the Coast Guard, tests of which shall be witnessed by an inspector.

Class B: Certified materials tested by the manufacturers, and certified by them as conforming to the requirements.

Class C: Materials for nonpressure parts of boilers or unfired pressure vessels such as casings for water-tube boilers, uptakes, furnace fronts, and operating equipment shall be of good commercial quality. No detail requirements are herein specified for materials in this class. Class C materials shall be accepted by inspectors without requiring tests or certification by manufacturers.

(b) Except as may be otherwise required, the classification of materials under classes A and B and the subparts of this part in which they are specified, are as follows:

CLASS A

| Subparts | |
|---|---|
| 51.04 | Marine boiler steel plate. |
| 51.07 | Staybolt and rivet steel. |
| 51.10 | Steel bars and shapes. |
| 51.13 | Staybolt and rivet iron. |

CLASS B

| | |
|---|---|
| 51.22 | Flange and firebox steel plates. |
| 51.23 | Corrosion resisting steel plate, sheet, and strip for unfired pressure vessels. |
| 51.24 | Materials for low temperature service. |
| 51.25 | Carbon and alloy-steel wrought iron tubes. |
| 51.34 | Carbon and alloy-steel wrought iron pipe. |
| 51.46 | Steel forgings. |
| 51.49 | Carbon and alloy-steel bolting and nut material. |
| 51.58 | Steel castings. |
| 51.61 | Iron castings. |
| 51.67 | Copper and copper-alloy plate. |
| 51.70 | Seamless copper and copper-alloy pipe. |
| 51.73 | Seamless copper and copper-alloy tubes. |
| 51.76 | Copper-alloy castings. |
| 51.79 | Aluminum-alloy plates and sheets. |
| 51.90 | Rigid poly (vinyl chloride) (PVC) materials. |

### § 51.01–15 Inspection and testing of class A material.

Inspectors shall have free entry at all times to those parts of the works where material subject to the regulations in this part is being manufactured. The manufacturer shall afford inspectors all reasonable facilities to satisfy them that the material is being manufactured in accordance with the requirements of the Commandant. Unless otherwise authorized, tests and inspection shall be made at the place of manufacture prior to shipment and shall be so conducted as not to interfere unnecessarily with the operation of the works. Inspectors shall assure themselves that test specimens are marked for positive identification with the materials which they represent. Unless otherwise specified, tests shall be made at ordinary temperature.

### § 51.01–20 Chemical analyses.

(a) A ladle analysis of each melt of class A materials shall be made by the manufacturer and a certified report thereof shall be furnished by him to the inspector upon request. This analysis shall be made from a test ingot taken during the pouring of the melt. The chemical composition thus determined shall conform to the specified requirements. This requirement shall apply also to the following class B materials:

(1) Flange and firebox quality steel plates specified in Subpart 51.22.

(2) Steel forgings specified in Subpart 51.46.

(3) Alloy-steel bolting material specified in Subpart 51.49.

(4) Steel castings specified in Subpart 51.58.

(5) Copper-alloy plate specified in Subpart 51.67.

(6) Copper-alloy castings specified in Subpart 51.76.

(b) A check analysis may be made at the discretion of the Commandant from test specimens representing material for which chemical composition is specified in any section of this part, in either class A or B. The chemical composition thus determined shall conform to the requirements.

### § 51.01–25 Certification of class B material.

(a) Certification of chemical analyses and physical tests of materials of class B shall be an affidavit by the manufacturer certifying that all materials of this class supplied by him for marine service do, or will conform to all the requirements of the regulations in this part applicable thereto.

(b) Materials in this class are not required to be tested in the presence of an inspector, but whenever deemed necessary by the Commandant, he may detail an inspector to witness such tests and satisfy himself that the requirements of the specification for class B materials are met.

### § 51.01–30 Tension tests.

(a) All tension tests shall be made on standard calibrated machines. The yield point in tension tests shall be determined by the drop of the beam or the halt in the gage of the testing machine. Except where otherwise specified in this part, the speed of the crosshead of the ma-

chine shall not exceed $\frac{1}{16}$ inch per minute per inch of gage length up to the yield point, nor shall it exceed $\frac{1}{2}$ inch per minute per inch of gage length beyond the yield point. Any convenient speed of the crosshead may be used from the start of loading the test specimen until a value estimated as one-half of the yield point is reached. In determining the yield strength by use of an extensometer, the crosshead speed shall not exceed 0.025 inch per minute per inch of gage length. In the event the machine is stopped in taking readings, the speed may be exceeded in the take-up only. The ends of all test specimens shall be of form to fit the holders of the testing machine in such a way that the load will be axial.

(b) The test specimens and procedures employed for the mechanical testing of steel products covered by the specifications listed in this part shall be in conformance with A.S.T.M. A370–60T, except as otherwise provided for in this subchapter.

### § 51.01–40 Retests.

When the result of any of the physical tests specified for any of the materials does not conform to the requirements, two additional specimens may, at the request of the manufacturer, be taken from the same lot and tested in the manner specified, but in such case, both of the specimens shall conform to the requirements. In the case of tension tests, this retest shall be allowed if the percentage of elongation obtained is less than required, or if any part of the fracture is outside of the middle third of the gauge length. If any test specimen develops flaws, it shall be discarded and another specimen from the same lot substituted.

### § 51.01–45 Rejections.

Failure of the tests (or retests) specified in the regulations in this subchapter for each particular material shall be cause for rejection. Unless otherwise required, any rejection shall be reported by the inspector within 5 working days from the receipt of the test specimen. Acceptance of material on results of tests at the place of manufacture shall not prejudice the right to reject any of such material in which injurious defects are subsequently discovered. The manufacturer shall be promptly notified of such subsequent rejections, and the records shall be corrected.

### § 51.01–50 Appeals.

In case of dissatisfaction with the results of any test, the manufacturer may appeal to the Coast Guard District Commander from the decision of the Officer in Charge, Marine Inspection. Should the Coast Guard District Commander sustain the Officer in Charge, Marine Inspection, the manufacturer may appeal to the Commandant. Tested specimens which represent rejected material shall be retained for at least 30 days.

### § 51.01–55 Process of steel manufacture.

Unless otherwise officially authorized by the Commandant, all wrought steel to be used in the construction of boilers or unfired pressure vessels to be installed on vessels shall be manufactured by the open-hearth, electric furnace, or crucible process.

### § 51.01–60 Stamping plates and specimens.

(a) Class A plates shall be stamped by the manufacturer, before they are tested, with his name or trademark, the word "Marine", the letter indicating the grade of the steel, and the minimum tensile strength of the plate in pounds per square inch expressed in thousands. Inspectors shall permit cutting a plate into two or more parts before testing, but each part shall be stamped or matchmarked for identification before cutting. All plates accepted by the inspector as conforming to the requirements shall be stamped by him near the manufacturer's stamp with the official stamp of the Coast Guard, the initials of his name, and the serial number. All test specimens shall be ring-stamped or matchmarked for identification before being detached. Plates shall be stamped lengthwise in two places on one long side about 18 inches from the edges at the corners. Each butt strap shall be stamped lengthwise of the plate about the middle of the strap.

(b) The impression of the official stamp of the Coast Guard for stamping plates and specimens shall be as shown below:

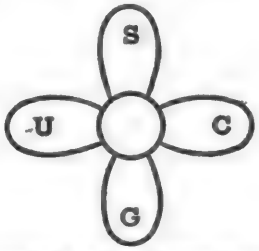


FIGURE 51.01–60 (b)—Official stamp.

### § 51.01–65 Stock plates.

Plates may be ordered to be carried in stock ashore or on shipboard for repairs to boilers and unfired pressure vessels. Such plates shall be inspected and tested at the place of manufacture and stamped for identification as stock plates. A test report for such plates shall be furnished to the Coast Guard District Commander of the district where the purchaser is located, with a copy to the purchaser. The Coast Guard District Commander shall furnish a copy thereof to the Officer in Charge, Marine Inspection, in the district where the material is kept in stock, and if the material is to be used by persons other than the original purchaser, they shall also be furnished with a copy of such report, for submittal by them to the Officer in Charge, Marine Inspection, in the district where the repairs are actually to be made before the material may be used. Vessels carrying such stock plates shall obtain and carry identification and test records of each plate. Where such plates are cut into pieces for repairs, the Officer in Charge, Marine Inspection, shall, upon request, stamp each piece so detached for identification with the original plate and a record of such stamping shall be made.

### § 51.01–70 Workmanship and finish.

All materials within the scope of the regulations in this subchapter shall be free from injurious defects and shall have a workmanlike finish.

### § 51.01–75 Heat treatment.

Some of the materials herein specified require heat treatment. This may consist of annealing, or of normalizing, or of normalizing followed by annealing, or of normalizing followed by a draw back to a temperature below the critical range. Annealing shall consist of allowing material to cool after forging or rolling to a temperature below the critical range, then reheating it to proper temperature to refine the grain and allowing it to cool in the furnace. Normalizing shall consist of allowing material to cool after forging or rolling to a temperature below the critical range, then reheating it to proper temperature to refine the grain and allowing it to cool in still air.

### § 51.01–80 Reclassification of materials.

When more than one grade is specified for any material or purpose and tests of a material of a superior grade fail to meet the requirements, such material may be reclassified and accepted as a specified lower grade if it fulfills the specified requirements for the latter. In such cases, the material shall be restamped or re-marked as required for proper identification, and revised records shall be made to cover it.

### § 51.01–85 Alternative materials.

If, in the development of industrial arts, other suitable or improved materials differing from those specified in this part are developed, their use will be given consideration, upon formal application to the Commandant with full information as to the characteristics of the material, and such scientific data and facts as may be necessary to establish the suitability and safety of the material for the use proposed. The material requirements in this subchapter are minimum requirements and are not intended to bar better materials.

### § 51.01–90 Material specification standards.

(a) The specifications prescribed in this part cover materials for use in the construction of boilers, unfired pressure vessels, piping, valves, fittings, and appurtenances, and shall comply with the standard specifications issued by the American Society for Testing Materials (A. S. T. M.), as listed in this part, subject to the limitations noted in the applicable subparts.

(b) Reference copies of all A. S. T. M. specifications listed in this part are available for reading purposes at U. S. Coast Guard Headquarters, Washington, D.C., 20226, and are on file with various Coast Guard District Commanders.

(c) The A. S. T. M. Standards referred to in this subchapter may be purchased

from the American Society for Testing Materials, 1916 Race Street, Philadelphia, Pa., 19103.

## Subpart 51.04—Marine Boiler Steel Plate

### § 51.04–1 Scope.

(a) The material specifications covering marine boiler steel plate subject to class A inspection shall comply with the following standard specifications issued by the American Society for Testing Materials, subject to the limitations given in this subpart:

TABLE 51.04-1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| A201–61T | A and B | A201—A and B. |
| A212–61T | A and B | A212—A and B. |
| A204–61 | A, B, and C | A204—A, B, and C. |
| A202–56 | A | A202—A. |
| A203–61 | A, B, D, E | A203—A, B, D, and E. |
| A225–56 | A and B | A225—A and B. |
| A299–56 | A | A299—A. |
| A302–56 | A and B | A302—A and B. |
| A353–58 | A and B | A353—A and B. |
| A357–58 | | A357—A. |
| A387–61T | A, B, C, D, E | A387—A, B, C, D, and E. |

(b) Steel plates for any part of a boiler subject to pressure and exposed to the fire or products of combustion shall be of firebox quality, steel plates for any part of a boiler subject to pressure and not exposed to the fire or products of combustion shall be of either flange or firebox quality.

(c) The grades listed in paragraph (a) of this section are suitable for arc or gas welding, but are not suitable for forge welding.

(d) Sufficient discard from the top of each ingot shall be made at any stage of the manufacture, to secure freedom from piping and undue segregation in the finished product, but in no case shall the amount of top discard be less than 30 percent.

### § 51.04–5 Heat treatment.

(a) Plates over 2 inches in thickness, before being fabricated, shall be uniformly heat-treated to produce grain refinement. Heat treatment involving quenching in a liquid medium is prohibited. If this treatment is not done at the rolling mill, the testing shall be carried out in accordance with paragraph (d) of this section.

(b) When plates are heat-treated to produce grain refinement the test specimens and the plates shall be stamped "G. R." The tensile strength of the plates in the grain-refined state shall be not less than the minimum of the specified range.

(c) Orders to the plate manufacturer or the fabricator shall specify when plates subject to the requirements of this section are to be stress-relieved and when they are to be heat-treated for grain-refinement so that proper provision may be made for the treatment of test specimens.

(d) When a fabricator, equipped to perform the work, elects to do the required heat treatment of plates for grain refinement, he shall accept the plates on the basis of the mill tests. The plate manufacturer shall make the tests prescribed in this subpart. The tension and bend test specimens shall be prepared from full thickness pieces heat-treated under conditions he considers appropriate for grain refinement and to meet the test requirements. The manufacturer shall inform the fabricator of the procedure followed in treating the pieces at the mill for guidance in treating the plates. The required physical properties shall be determined after heat treatment of the plates on specimens prepared from pieces similarly and simultaneously treated with the plates. Pieces for two tension tests, one top and one bottom, shall be provided from each plate as rolled. These pieces shall be stamped by the inspector with his official stamp for identification.

NOTE: The term "plate as rolled" as used in this section and in § 51.04–10 (c) refers to the unit plate rolled from a slab or directly from an ingot in its relation to the location and number of specimens; not to its condition.

(e) In the case of plates over 2 inches in thickness which subsequently are to be stress-relieved, the test specimens for such plates shall, before testing, be stress-relieved following the heat treatment for grain refinement.

### § 51.04–10 Test specimens.

(a) For plates 2 inches and under in thickness, tension and bent test specimens shall be the full thickness of the material and shall be machined to the form and dimensions shown in figure 51.04–10(a); or the bend test specimen may be machined with both edges parallel.

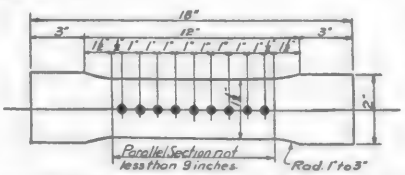


FIGURE 51.04–10 (a)—Standard rectangular tension-test specimen with 8-inch gauge length.

(b) For grade A or B plates over 2 inches and not over 4 inches in thickness, tension-test specimens may be the full thickness of the material and of the form shown in figure 51.04–10 (a); when adequate testing machine capacity is available.

(c) For plates over 2 inches in thickness, except as permitted in paragraph (b) of this section, tension-test specimens shall be machined to the form and dimensions shown in figure 51.04–10 (c); and the axis of each such specimen shall be located midway between the center and the top or bottom surface of the plate. The bend test specimens shall be at least 1½ inches in width, with both edges parallel, and may be reduced to 2 inches in thickness; but shall have one surface as rolled.

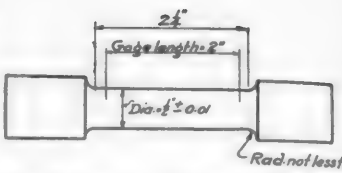


FIGURE 51.04–10 (c)—Standard round tension-test specimen with 2-inch gauge length.

### § 51.04–15 Marking.

The quality classification to be marked on all class A plates in accordance with § 51.01–60 shall be the word, "Marine" followed by the letter designating the grade of the steel.

## Subpart 51.07—Staybolt and Rivet Steel

### § 51.07–1 Scope.

The material specifications covering staybolt and rivet steel subject to class A inspection shall comply with the following standard specifications issued by the American Society for Testing Materials:

TABLE 51.07-1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| A31–55 | A | A |
| A31–55 | B | B |
| A202–56 | A | C |

## Subpart 51.10—Steel Bars and Shapes

### § 51.10–1 Scope.

(a) The material specifications covering round steel bars and structural steel shapes subject to class A inspection shall comply with the following standard specification issued by the American Society for Testing Materials, subject to the limitations noted in this subpart:

| A. S. T. M. designation: | Grade |
|---|---|
| A107–58T | 1010 through 1030 |

### § 51.10–5 Process.

The steel shall be made by either or both of the following processes: open-hearth or electric-furnace.

### § 51.10–10 Chemical composition.

The steel shall conform to the following requirements as to chemical composition:

| | |
|---|---|
| Phosphorus, maximum, percent: | |
| Acid | 0.05 |
| Basic | .04 |
| Sulfur, maximum percent | .05 |

### § 51.10–15 Tensile properties.

The material shall conform to the following requirements as to tensile properties:

| | |
|---|---|
| Tensile strength, p. s. i. | 55,000 to 65,000 |
| Yield point, p. s. i. | 0.5 tensile strength |
| Elongation in 8 inches, minimum, percent | 17. |
| Elongation in 2 inches, minimum, percent | 20. |

### § 51.10–20 Modification in elongation.

For material over ¾ inch in thickness, a deduction from the percentages of elongation specified in § 51.10–15 of 0.125 percent shall be made for each increase of 1/32 inch of the specified thickness above ¾ inch.

### § 51.10–25 Bending properties.

The bend test specimen shall stand being bent cold through 180° without cracking on the outside of the bent portion to an inside diameter which shall have the following relation to the thickness of the specimen:

TABLE 51.10–25—BENDING TEST

| Thickness of material | Ratio of inside diameter of bend to thickness of specimen |
|---|---|
| ¾ inch and under | ½ |
| Over ¾ to 1 inch, inclusive | 1 |
| Over 1 to 1½ inches, inclusive | 1½ |
| Over 1½ to 2 inches, inclusive | 2½ |
| Over 2 inches | 3 |

### § 51.10–30 Test specimens.

(a) Test specimens shall be of the full thickness or diameter of material as rolled, except as specified in paragraphs (b) and (c) of this section.

(b) Test specimens for shapes and flats may be machined to the form and dimensions shown in figure 51.04–10 (a), or with both edges parallel.

(c) Test specimens for bars over 1½ inches in thickness or diameter may be machined to a thickness or diameter of at least ¾ inch for a length of at least 9 inches; or tension test specimens may conform to the dimensions shown in figure 51.04–10 (c). Bend test specimens may be 1 by ½ inch in section.

### § 51.10–35 Number of tests.

(a) One tension and one bend test shall be made from each melt; except that if material from one melt differs ⅜ inch or more in thickness, one tension and one bend test shall be made from both the thickest and the thinnest material rolled.

(b) If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted.

(c) If the percentage of elongation of any tension test specimen is less than that specified in § 51.10–15 and any part of the fracture is more than ¾ inch from the center of the gauge length of a 2-inch specimen, or is outside the middle third of the gauge length of an 8-inch specimen, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

### § 51.10–40 Finish.

The finished material shall be free from injurious defects and shall have a workmanlike finish.

### § 51.10–45 Marking.

Bars shall, when loaded for shipment, be properly separated, and marked with the name or brand of the manufacturer and melt number for identification. The melt number shall be legibly marked on each test specimen.

## Subpart 51.13—Staybolt and Rivet Iron

### § 51.13–1 Scope.

(a) The material specifications covering wrought iron bars for stays and staybolts and wrought iron rivets subject to Class A inspection shall comply with the following standard specifications issued by the American Society for Testing Materials:

TABLE 51.13–1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| A84–60T | Staybolts | A |
| A152–60T | Rivets | B |

## Subpart 51.22—Flange and Firebox Steel Plates

### § 51.22–1 Scope.

(a) The material specifications covering carbon steel plate of flange and firebox quality, Class B, certified material, shall comply with the following standard specification issued by the American Society for Testing Materials:

TABLE 51.22–1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| A285–57T | A (flange quality) | A |
| A285–57T | B (flange quality) | B |
| A285–57T | C (flange quality) | C |
| A285–57T | A (firebox quality) | A |
| A285–57T | B (firebox quality) | B |
| A285–57T | C (firebox quality) | C |
| A410–61T | | |

## Subpart 51.23—Corrosion Resisting Steel Plate, Sheet and Strip for Unfired Pressure Vessels

### § 51.23–1 Scope.

(a) The material specifications for corrosion resisting steel plate, sheet, and strip, Class B, certified materials, shall comply with the following standard specifications issued by the American Society for Testing Materials:

TABLE 51.23–1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| A240–63 | Type 302 | Type 302. |
| A240–63 | Type 304 | Type 304. |
| A240–63 | Type 304L | Type 304L. |
| A240–63 | Type 309S | Type 309S. |
| A240–63 | Type 310S | Type 310S. |
| A240–63 | Type 316 | Type 316. |
| A240–63 | Type 316L | Type 316L. |
| A240–63 | Type 317 | Type 317. |
| A240–63 | Type 321 | Type 321. |
| A240–63 | Type 347 | Type 347. |
| A240–63 | Type 348 | Type 348. |
| A240–63 | Type 405 | Type 405. |
| A240–63 | Type 410 | Type 410. |
| A240–63 | Type 410S | Type 410S. |
| A240–63 | Type 430A | Type 430A. |
| A240–63 | Type 430B | Type 430B. |

## Subpart 51.24—Materials for Low Temperature Service

### § 51.24–1 Scope.

(a) The material specifications for materials for service at low temperatures shall comply with the following standard specifications of the American Society for Testing Materials, subject to the limitations noted in this subpart:

TABLE 51.24–1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | Materials |
|---|---|
| A300–58 | Steel plates for pressure vessels for service at low temperatures. |
| A333–63T | Seamless and welded steel pipe for low temperature service. |
| A334–63T | Seamless and welded steel tubes for low temperature service. |
| A350–61T | Forged or rolled carbon and alloy steel flanges, forged fittings, and valves and parts for low temperature service. |
| A352–60T | Ferritic steel castings for pressure containing parts suitable for low temperature service. |

(b) Acceptance of materials listed in this subpart will be contingent upon the impact properties of the material tested at such temperatures and by such methods as may be required by the Commandant.

## Subpart 51.25—Carbon and Alloy-Steel and Wrought Iron Tubes

### § 51.25–1 Scope.

(a) The material specifications covering steel and iron tubes, Class B, certified material, shall comply with the following standard specifications issued by the American Society for Testing Materials, subject to the limitations noted in this subpart:

TABLE 51.25–1(a)—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| Carbon-steel and iron: | | |
| A83–63T | Low-carbon seamless steel | T83 |
| A178–63T | A (low-carbon electric-resistance welded steel). | T178–A |
| A178–63T | C (medium-carbon electric-resistance welded steel). | T178–C |
| A179–63T | Low-carbon seamless steel condenser tubes. | T179 |
| A192–63T | Low-carbon seamless steel | T192 |
| A210–63T | Medium-carbon seamless steel. | T210 |
| A226–63T | Electric resistance welded steel. | T226 |
| Alloy steel: | | |
| A209–63T | T1 | T1 |
| A209–63T | T1a | T1a |
| A209–63T | T1b | T1b |
| A213–63T | T2 | T2 |
| A213–63T | T5 | T5 |
| A213–63T | T5b | T5b |
| A213–63T | T7 | T7 |
| A213–63T | T9 | T9 |
| A213–63T | T11 | T11 |
| A213–63T | T12 | T12 |
| A213–63T | T17 | T17 |
| A213–63T | T21 | T21 |
| A213–63T | T22 | T22 |
| A213–63T | TP304 | T304 |
| A213–63T | TP304L | T304L |
| A213–63T | TP310 | T310 |
| A213–63T | TP316 | T316 |
| A213–63T | TP316L | T316L |
| A213–63T | TP321 | T321 |
| A213–63T | TP321H | T321H |
| A213–63T | TP347 | T347 |
| A213–63T | TP348 | T348 |
| A250–63T | T1 | T1 |
| A250–63T | T1a | T1a |
| A250–63T | T1b | T1b |
| A423–63T | | |

(b) Grade T179 shall be permitted only for use as tube material in heat exchangers and tubing for hydraulic systems.

## Subpart 51.34—Carbon and Alloy-Steel and Wrought Iron Pipe

### § 51.34–1 Scope.

(a) The material specifications covering steel and wrought iron pipe, Class B, certified material, shall comply with the following standard specifications issued by the American Society for Testing Materials:

TABLE 51.34–1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| Carbon-steel and iron: | | |
| A53–63T | Butt-welded steel | P53–BW |
| A53–63T | A (seamless steel) | P53–A |
| A53–63T | B (seamless steel) | P53–B |
| A53–63T | A (electric-resistance welded steel). | P53–RW–A |
| A53–63T | B (electric-resistance welded steel). | P53–RW–B |
| A106–63T | A (seamless steel) | P106–A |
| A106–63T | B (seamless steel) | P106–B |
| A106–63T | C (seamless steel) | P106–C |
| A135–63T | A (electric-resistance welded steel). | P135–A |
| A135–63T | B (electric-resistance welded steel). | P135–B |
| A72–62T | Lap-welded wrought iron. | P72–LW |
| A72–62T | Butt-welded wrought iron. | P72–BW |
| Alloy steel: | | |
| A312–63T | TP304 | P304 |
| A312–63T | TP304L | P304L |
| A312–63T | TP309 | P309 |
| A312–63T | TP310 | P310 |
| A312–63T | TP316 | P316 |
| A312–63T | TP316L | P316L |
| A312–63T | TP317 | P317 |
| A312–63T | TP321 | P321 |
| A312–63T | TP347 | P347 |
| A312–63T | TP348 | P348 |
| A335–63T | P1 | P1 |
| A335–63T | P2 | P2 |
| A335–63T | P5 | P5 |
| A335–63T | P5C | P5C |
| A335–63T | P7 | P7 |
| A335–63T | P9 | P9 |
| A335–63T | P11 | P11 |
| A335–63T | P12 | P12 |
| A335–63T | P15 | P15 |
| A335–63T | P21 | P21 |
| A335–63T | P22 | P22 |

## Subpart 51.46—Steel Forgings

### § 51.46–1 Scope.

The material specifications covering carbon-steel and alloy-steel pipe flanges, forged fittings, valves and parts of class B, certified material, intended for general service and high-temperature service, shall comply with the following standard specifications issued by the American Society for Testing Materials, subject to the limitations noted in this subpart:

TABLE 51.46–1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| Carbon-steel: | | |
| A105–61T | I | F105–I |
| A105–61T | II | F105–II |
| A181–61T | I | F181–I |
| A181–61T | II | F181–II |
| Alloy-steel: | | |
| A182–61T | F1 | F1 |
| A182–61T | F5 | F5 |
| A182–61T | F5a | F5a |
| A182–61T | F6 | F6 |
| A182–61T | F7 | F7 |
| A182–61T | F9 | F9 |
| Alloy-steel—Con. | | |
| A182–61T | F11 | F11 |
| A182–61T | F12 | F12 |
| A182–61T | F21 | F21 |
| A182–61T | F22 | F22 |
| A182–61T | F304 | F304 |
| A182–61T | F304L | F304L |
| A182–61T | F310 | F310 |
| A182–61T | F316 | F316 |
| A182–61T | F316L | F316L |
| A182–61T | F321 | F321 |
| A182–61T | F347 | F347 |
| A182–61T | F348 | F348 |
| A234–59T | WPA | WPA |
| A234–59T | WPB | WPB |
| A234–59T | WPC | WPC |
| A234–59T | WPI | WPI |
| A234–59T | WP12 | WP12 |
| A234–59T | WP11 | WP11 |
| A234–59T | WP22 | WP22 |
| A234–59T | WP5 | WP5 |
| A336–62T | F1 | F1 |
| A336–62T | F2 | F2 |
| A336–62T | F5 | F5 |
| A336–62T | F5a | F5A |
| A336–62T | F6 | F6 |
| A336–62T | F22 | F22 |
| A336–62T | F8 | F8 |
| A336–62T | F8M | F8M |
| A336–62T | F8C | F8C |
| A336–62T | F8T | F8T |
| A336–62T | F25 | F25 |
| A403–61T | WP304 | WP304 |
| A403–61T | WP304L | WP304L |
| A403–61T | WP309 | WP309 |
| A403–61T | WP310 | WP310 |
| A403–61T | WP347 | WP347 |
| A403–61T | WP316 | WP316 |
| A403–61T | WP316L | WP316L |
| A403–61T | WP317 | WP317 |
| A403–61T | WP321 | WP321 |
| A403–61T | WP348 | WP348 |

### § 51.46–5 Hydrostatic tests.

Valves and pipe fittings shall be tested after machining to a hydrostatic pressure as required by § 61.30–5 of this subchapter.

## Subpart 51.49—Carbon and Alloy-Steel Bolting and Nut Material

### § 51.49–1 Scope.

The material specifications covering carbon and alloy-steel bolts and nuts of class B, certified material, shall comply with the following standard specifications of the American Society for Testing Materials:

TABLE 51.49–1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| Carbon-steel bolting: | | |
| A307–63T | B | B |
| Alloy-steel bolting: | | |
| A193–62T | B5 (5 Cr–0.50 Mo) | B5 |
| A193–62T | B6 (12 Cr) | B6 |
| A193–62T | B7 (1 Cr–0.20 Mo) | B7 |
| A193–62T | B14 (1 Cr–0.35 Mo–0.25 Va) | B14 |
| A193–62T | B16 (1 Cr–0.55 Mo–0.30 Va) | B16 |
| A193–62T | B8C (18 Cr–8 Ni+Co) | B8C |
| A193–62T | B8T (18 Cr–8 Ni+Ti) | B8T |
| Carbon and alloy steel nuts: | | |
| A194–62T | 1 (carbon-steel) | 1 |
| A194–62T | 2 (carbon-steel) | 2 |
| A194–62T | 2H (carbon-steel) | 2H |
| A194–62T | 3 (5 Cr–0.50 Mo–0.10 Si) | 3 |
| A194–62T | 4 (0.15 Si–0.20 Mo) | 4 |

## Subpart 51.58—Steel Castings

### § 51.58–1 Scope.

(a) The material specifications covering carbon and alloy-steel castings of class B, certified material, shall comply with the following standard specifications issued by the American Society for Testing Materials, subject to the limitations noted in this subpart:

TABLE 51.58–1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| Carbon-steel: | | |
| A216–63T | WCA | WCA |
| A216–63T | WCB | WCB |
| Alloy-steel: | | |
| A217–60T | WC1 (C–Mo) | WC1 |
| A217–60T | WC4 (1 Ni–0.65 Cr–0.50 Mo). | WC4 |
| A217–60T | WC5 (0.80 Ni–0.70 Cr–1 Mo.) | WC5 |
| A217–60T | WC6 (1.25 Cr–0.50 Mo) | WC6 |
| A217–60T | WC9 (2.25 Cr–1 Mo) | WC9 |
| A217–60T | C5 (5 Cr–0.50 Mo) | C5 |
| A217–60T | C12 (9 Cr–1 Mo) | C12 |
| A351–63T | CA15 | CA15 |
| A351–63T | CF8 | CF8 |
| A351–63T | CF8M | CF8M |
| A351–63T | CF8C | CF8C |
| A351–63T | CH20 | CH20 |
| A351–63T | CK20 | CK20 |

(b) Grades C5, C12, WCA, WCB, WC1, WC4, WC5, WC6, and WC9 are suitable for arc or gas welding. Other grades may be considered weldable when employing proper welding technique approved by the Commandant.

### § 51.58–5 Hydrostatic tests.

(a) Valves and pipe fittings shall be tested after machining to a hydrostatic pressure as required by § 61.30–5 of this subchapter.

(b) Pressure containing castings other than those specified in paragraph (a) in this section shall be tested to a hydrostatic pressure of 2 times the maximum allowable pressure and show no leaks.

## Subpart 51.61—Iron Castings

### § 51.61–1 Scope.

The material specifications covering nodular cast iron, malleable iron and gray iron castings of Class B, certified material, used for pipe fittings, valves, flanges and manifolds, shall comply with the following standard specifications issued by the American Society for Testing Materials, subject to the limitations noted in this subpart:

TABLE 51.61–1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| Nodular iron: | | |
| A395–61 | 60–45–15 | 60–45–15. |
| Malleable iron: | | |
| A47–61 | 32510 | A1. |
| A47–61 | 35018 | A2. |
| A197–47 | Cupola | B. |
| Cast iron: | | |
| A126–61T | Class A (regular) | C. |
| A126–61T | Class B (higher strength). | D. |
| A126–61T | Class C (high test) | E. |
| A278–62T | Class No. 20 | No. 20. |
| A278–62T | Class No. 25 | No. 25. |
| A278–62T | Class No. 30 | No. 30. |
| A278–62T | Class No. 35 | No. 35. |
| A278–62T | Class No. 40 | No. 40. |
| A278–62T | Class No. 50 | No. 50. |
| A278–62T | Class No. 60 | No. 60. |

### § 51.61–5 Hydrostatic tests.

Castings intended for use as valves and pipe fittings shall be tested after machining to a hydrostatic pressure as required by § 61.30–5 of this subchapter.

§ 51.61–10 Markings.

Each nodular iron casting shall be legibly marked for material identification, either by casting or stamping, with the A. S. T. M. designation or grade.

## Subpart 51.67—Copper and Copper-Alloy Plate

§ 51.67–1 Scope.

(a) The material specifications covering copper and copper-alloy rolled plate of class B, certified material, suitable for use as shells and tube sheets of heat exchangers and unfired pressure vessels, shall comply with the following standard specifications issued by the American Society for Testing Materials, subject to the limitations noted in this subpart:

TABLE 51.67–1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| Copper: | | |
| B11–61 | Type ETP (tough pitch copper nonarsenical). | B11–1. |
| B11–61 | Type DHP (phosphorized copper nonarsenical). | B11–2. |
| B11–61 | Type ATP (tough pitch arsenical copper). | B11–3. |
| B11–61 | Type DPA (phosphorized arsenical copper). | B11–4. |
| Copper-alloy: | | |
| B96–61 | Copper silicon alloy A or C | B96–A or C. |
| B169–55 | Aluminum bronze alloy D | B169–D. |
| B171–58 | Naval brass | B171–A. |
| B171–58 | Admiralty metal | B171–B. |
| B171–58 | Copper-nickel alloy 70–30 | B171–C. |
| B171–58 | Copper-nickel alloy 90–10 | B171–D. |
| B171–58 | Aluminum bronze alloy D | B171–E. |
| B171–58 | Aluminum bronze alloy E | B171–F. |
| B–402 | Copper-nickel alloy 70–30 | B–402–A. |
| B–402 | Copper-nickel alloy 90–10 | B–402–B. |

(b) When copper plates are to be welded, grades B11–2 and B11–4 only shall be employed.

## Subpart 51.70—Seamless Copper and Copper-Alloy Pipe

§ 51.70–1 Scope.

The material specifications covering seamless copper and copper-alloy pipe, of class B, certified material, shall comply with the following standard specifications issued by the American Society for Testing Materials:

TABLE 51.70–1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| B42–58 | Seamless copper | B42 |
| B43–58 | Red brass | B43 |

## Subpart 51.73—Seamless Copper and Copper-Alloy Tubes

§ 51.73–1 Scope.

(a) The material specifications covering seamless copper and copper-alloy tubes, of class B, certified material, shall comply with the following standard specifications issued by the American Society for Testing Materials, subject to the limitations noted in this subpart:

TABLE 51.73–1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| B88–61 | Copper Type K | B88–K. |
| B88–61 | Copper Type L | B88–L. |
| B88–61 | Copper Type M | B88–M. |
| B75–61 | Oxygen-free copper | B75–D. |
| B75–61 | Phosphorized copper Type DPL. | B75–A. |
| B75–61 | Phosphorized copper Type DHP. | B75–B. |
| B75–61 | Phosphorized arsenical copper Type DPA. | B75–C. |
| B111–60 | Copper | B111–A. |
| B111–60 | Arsenical copper | B111–B. |
| B111–60 | Red brass | B111–C. |
| B111–60 | Admiralty metal grades A, B, C, and D. | B111–D. |
| B111–60 | Aluminum brass grade B. | B111–E. |
| B111–60 | Aluminum bronze | B111–F. |
| B111–60 | Copper-nickel 70–30 | B111–G. |
| B111–60 | Copper-nickel 80–20 | B111–H. |
| B111–60 | Copper-nickel 90–10 | B111–I. |

(b) When copper tubes are to be welded, deoxidized copper shall be employed.

## Subpart 51.76—Copper-Alloy Castings

§ 51.76–1 Scope.

The material specifications covering bronze castings of class B, certified material, for pressure-containing parts of valves, pipe fittings, and similar appliances, shall comply with the following standard specifications issued by the American Society for Testing Materials, subject to the limitations noted in this subpart:

TABLE 51.76–1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| B61–60 | Steam or valve bronze. | 2A. |
| B62–60 | Composition bronze or ounce metal. | 4A. |
| B143–61 | Tin bronze, 1A | 1A. |
| B143–61 | Tin bronze, 1B | 1B. |

§ 51.76–5 Hydrostatic tests.

Castings intended for use as pipe flanges and flanged fittings shall be tested after machining to a hydrostatic test as required by § 61.30–5 of this subchapter.

## Subpart 51.79—Aluminum-Alloy Plates and Sheets

§ 51.79–1 Scope.

(a) The material specifications covering aluminum-alloy plate and sheet of Class B, certified material, suitable for use as shells and tube sheets of unfired pressure vessels and heat exchangers, shall comply with the following standard specifications issued by the American Society for Testing Materials:

TABLE 51.79–1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | | Coast Guard grade |
|---|---|---|---|
| | Alloy | Temper | |
| B209–61 | 1060 | 0 | 1060–0. |
| B209–61 | 1100 | 0 | 1100–0. |
| B209–61 | 3003 | 0 | 3003–0. |
| B209–61 | 3004 | 0 | 3004–0. |
| B209–61 | 5050 | 0 | 5050–0. |
| B209–61 | 5052 | 0 | 5052–0. |
| B209–61 | 5083 | 0 | 5083–0. |
| B209–61 | 5086 | 0 | 5086–0. |
| B209–61 | 5154 | 0 | 5154–0. |
| B209–61 | 5456 | 0 | 5456–0. |
| B209–61 | 6061 | T6 | 6061–T6. |

## Subpart 51.80—Aluminum-Alloy Pipe and Tubes

§ 51.80–1 Scope.

(a) The material specifications covering aluminum-alloy pipe and tubes of Class B, certified materials shall comply with the following standard specifications issued by the American Society for Testing Materials:

TABLE 51.80–1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | | Coast Guard grade |
|---|---|---|---|
| | Alloy | Temper | |
| B210–61 | 1060 | 0 | 1060–0. |
| B210–61 | 3003 | 0 | 3003–0. |
| B210–61 | 5154 | 0 | 5154–0. |
| B210–61 | 6061 | T6 | 6061–T6. |
| B210–61 | 6063 | T6 | 6063–T6. |
| B234–61 | 6061 | T6 | 6061–T6. |
| B235–61 | 1060 | 0 | 1060–0. |
| B235–61 | 3003 | 0 | 3003–0. |
| B235–61 | 5154 | 0 | 5154–0. |
| B235–61 | 5456 | 0 | 5456–0. |
| B235–61 | 6061 | T6 | 6061–T6. |
| B235–61 | 6063 | T6 | 6063–T6. |
| B241–61 | 5456 | 0 | 5456–0. |
| B241–61 | 6061 | T6 | 6061–T6. |
| B241–61 | 6063 | T6 | 6063–T6. |

## Subpart 51.81—Aluminum-Alloy Forgings

§ 51.81–1 Scope.

(a) The material specifications covering aluminum-alloy forgings of Class B, certified materials, shall comply with the following standard specifications issued by the American Society for Testing Materials:

TABLE 51.81–1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | | Coast Guard grade |
|---|---|---|---|
| | Alloy | Temper | |
| B247–61 | 3003 | F | 3003–F. |
| B247–61 | 6061 | T6 | 6061–T6. |
| B247–61 | 6063 | T6 | 6063–T6. |

## Subpart 51.82—Aluminum-Alloy Bars, Rods, and Shapes

§ 51.82–1 Scope.

(a) The material specifications covering aluminum-alloy bars, rods, and shapes of Class B, certified materials, shall comply with the following standard specifications issued by the American Society for Testing Materials:

TABLE 51.82-1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | | Coast Guard grade |
|---|---|---|---|
| | Alloy | Temper | |
| B211-61 | 6061 | 0 | 6061-T6. |
| B221-61 | 5083 | 0 | 5083-0. |
| B221-61 | 5154 | 0 | 5154-0. |
| B221-61 | 5456 | 0 | 5456-0. |
| B221-61 | 6061 | T6 | 6061-T6. |

## Subpart 51.85—Nickel-Alloy Plates and Sheets

### § 51.85-1 Scope.

(a) The material specifications covering nickel-alloy plates and sheets of Class B, certified materials, shall comply with the following standard specification issued by the American Society for Testing Materials:

TABLE 51.85-1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| B127-61 | Hot or cold rolled | B127. |

## Subpart 51.86—Nickel-Alloy Pipe and Tubes

### § 51.86-1 Scope.

(a) The material specifications covering nickel-alloy pipe and tubes of Class B, certified material, shall comply with the following standard specification issued by the American Society for Testing Materials:

TABLE 51.86-1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| B163-61 | Nickel copper alloy | B163. |
| B165-61 | | B165. |

## Subpart 51.90—Rigid Poly (Vinyl Chloride) (PVC) Materials

### § 51.90-1 Scope.

(a) The material specifications covering materials fabricated of rigid polyvinylchloride (PVC), Class B, certified materials, shall comply with the following standard specifications issued by the American Society for Testing Materials, subject to the limitations noted in this subpart:

TABLE 51.90-1—MATERIAL SPECIFICATIONS

| A.S.T.M. designation | A.S.T.M. grade | Coast Guard grade |
|---|---|---|
| D1784-60T | Type I, Grade 1 | |
| D1784-60T | Type I, Grade 2 | |
| D1784-60T | Type II, Grade 1 | |
| D1785-60T | Type I, Grade 1 | |
| D1785-60T | Type I, Grade 2 | |
| D1785-60T | Type II, Grade 1 | |

(b) PVC pipe that is to be used for potable water shall bear the seal of approval or NSF mark of the National Sanitation Foundation Testing Laboratory Incorporated, School of Public Health, University of Michigan, Ann Arbor, Mich., 48103.

# PART 52—CONSTRUCTION

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52.70-55 Salinometer cocks.

AUTHORITY: The provisions of this Part 52 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426–4431, as amended, 4433, as amended, 4434, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat.

675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404–409, 411, 412, 435, 481, 489, 366, 395, 363, 367, 526p, 1333, 390b; 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857.

## Subpart 52.01—Procedure and General Requirements

### § 52.01–1 Definitions.

(a) *Main boiler.* A main boiler is a steam boiler used for generating steam for propulsion purposes on shipboard.

(b) *Auxiliary or donkey boiler.* An auxiliary or donkey boiler is a steam boiler used for all purposes on shipboard for which steam may be required other than propulsion.

(c) *Pressure vessel.* A pressure vessel is a vessel containing gases, vapors, or liquids under pressure. (See § 54.01–5 of this subchapter.)

(d) *Water-tube boiler.* A water-tube boiler is a steam boiler in which the boiler tubes contain water and steam, the heat being applied to the outside surface of the tubes; and is composed generally of drums, headers, and tubes.

(e) *Internally-fired fire-tube boiler (Scotch boiler).* An internally-fired fire-tube boiler is a steam boiler containing furnaces, one or more combustion chambers and tubes or flues, which are surrounded by water and through which the products of combustion pass from the furnace to the uptake. In such boilers no part of the shell is in contact with the fire or products of combustion.

(f) *Externally fired fire-tube or flue boiler (horizontal return tubular).* An externally fired fire-tube or flue boiler is a steam boiler, part of the outer shell of which is exposed to fire or to the products of combustion, and containing flues through which such products pass from the furnace to the uptake.

(g) *Factor of safety.* Factor of safety is the ratio of the ultimate strength of the material to the maximum allowable stress.

(h) *Pressure or p. s. i.* Pressure or p. s. i. is the gauge pressure or the pressure above the atmospheric pressure in pounds per square inch.

(i) *Design pressure.* Design pressure is the theoretical bursting pressure of the weakest part of a boiler, pressure vessel, or piping divided by its factor of safety.

(j) *Maximum allowable pressure.* The maximum allowable pressure of a boiler and its appurtenances or of an unfired pressure vessel shall be considered as the highest setting of the safety valves or relief valves.

(k) *Repair.* Repair is the restoration of any damaged or impaired part to an effective and safe condition.

(l) *Alteration.* Alteration is a structural modification of or departure from an approved design or existing construction.

(m) *Packaged boiler.* A packaged boiler is a steam boiler equipped, and shipped complete with fuel burning equipment, mechanical draft equipment, feed water apparatus and all necessary controls for manual or automatic operation, all completely mounted on a common base and requiring only to be connected to fuel, water and electric supplies to be ready for use.

(n) *Fired steam boiler.* A pressure vessel in which steam is generated by the application of heat resulting from the combustion of fuel is classed as a fired steam boiler.

(o) *Unfired steam boilers.* An unfired pressure vessel in which steam is generated is classed as an unfired steam boiler. (See § 54.03–27 of this subchapter for requirements for unfired steam boilers.)

### § 52.01–5 Plans.

(a) Manufacturers intending to fabricate boilers, unfired pressure vessels or appliances of riveted, welded, brazed, or seamless material to be installed on vessels subject to inspection by the Coast Guard, shall submit detail plans in triplicate which shall be fully descriptive of the pressure containing parts of such boilers, unfired pressure vessels, or appliances to be manufactured, to the Officer in Charge, Marine Inspection, having jurisdiction over the vessel. When due to location of the shipyard or design office, such a procedure would result in unnecessary delay in transmission, the plans may be forwarded directly to the Commandant (MMT), U.S. Coast Guard, Washington, D.C., 20226.

(b) The procedure specified in paragraph (a) of this section shall apply also to proposed alterations in boilers, unfired pressure vessels, or appliances of riveted, welded, brazed, or seamless material.

(c) In addition to the requirements specified in paragraph (a) of this section, manufacturers intending to fabricate packaged boilers to be installed on vessels subject to inspection by the Coast Guard shall submit detail plans, in triplicate, fully descriptive of the manual or automatic features of such boilers, to the Commandant (MMT), U. S. Coast Guard, Washington, D.C., 20226. Manufacturers intending to fabricate automatically controlled packaged auxiliary boilers shall submit plans and descriptive data, in quadruplicate, as specified in Subpart 162.026 of Subchapter Q (Specifications) of this chapter.

### § 52.01–10 Automatically controlled packaged boilers.

All automatically controlled packaged auxiliary boilers shall be designed, constructed and tested in conformance with the requirements of Subpart 162.026 of Subchapter Q (Specifications) of this chapter.

### § 52.01–15 Conditions for approval.

(a) Manufacturers of boilers and unfired pressure vessels to be installed on vessels subject to inspection by the Coast Guard shall make calculations of the pressure parts of such boilers and unfired pressure vessels using the formulas provided in this subchapter, and submit such calculations for approval together with the drawings required by § 52.01–5. In making calculations, the design stress shall not exceed the maximum allowable stresses for the material.

(b) When it is determined that the design of the boiler or unfired pressure vessel complies with the requirements of this subchapter and, in the case of boilers, with the requirements of Part 162 of Subchapter Q (Specifications) of this chapter, the drawings shall be approved for the maximum allowable pressure at which the boiler or unfired pressure vessels may be operated. If it is determined that the design does not comply with the specified requirements, the manufacturer will be notified by a written statement which will list the reasons for disapproval.

### § 52.01–20 Appeals.

In case the design is disapproved by the Officer in Charge, Marine Inspection, the manufacturer may appeal within 30 days, to the Coast Guard District Commander of the district, and should the Coast Guard District Commander sustain the Officer in Charge, Marine Inspection, the manufacturer may, within 30 days, further appeal to the Commandant. The decision of the Commandant shall be final.

### § 52.01–25 Certifications and affidavits of manufacturers.

(a) In requesting inspection of a new boiler or pressure vessel subject to inspection by the Coast Guard, the manufacturer shall file with the Officer in Charge, Marine Inspection, a certification of a data report in triplicate on Form CG–2935 for boilers or Form CG–2936 for unfired pressure vessels. (See § 61.45–5 or § 61.45–10 of this subchapter.)

(b) Manufacturers of class B materials, such as pipe, valves, flanges, fittings, traps, separators, castings, forgings, etc., or appliances, proposed for use on vessels subject to inspection by the Coast Guard, shall file at Headquarters affidavits duly executed on Form CG–935A certifying that such materials or appliances will be manufactured in accordance with the regulations in this subchapter. (See § 61.45–15 of this subchapter.)

### § 52.01–30 Certification required for duplicate boilers or pressure vessels.

A manufacturer desiring to construct any boiler or pressure vessel which is identical with a boiler or pressure vessel previously approved by the Officer in Charge, Marine Inspection, shall not be required to resubmit drawings, but shall submit to the Officer in Charge, Marine Inspection, a certificate that the proposed boiler or pressure vessel conforms in every respect with drawings previously approved. Such certificate shall contain the boiler or pressure vessel number, the drawing number or numbers, and the date of approval. If, upon examination, the Officer in Charge, Marine Inspection, ascertains that the said approved drawings meet the requirements specified in § 52.01–15, the

manufacture of such boiler or pressure vessel shall be authorized. In case of disapproval of the request by the Officer in Charge, Marine Inspection, the manufacturer shall have the right of appeal, as specified in § 52.01–20.

**§ 52.01–35 Auxiliary, donkey, and low-pressure heating boilers.**

(a) All auxiliary and donkey boilers shall be designed, constructed, installed, and inspected in accordance with the requirements specified in this subchapter for main boilers, and shall be subject to the same initial procedure and general requirements.

(b) Low-pressure steam and hot-water heating boilers, the maximum allowable pressure of which does not exceed 30 pounds per square inch, shall conform to the requirements of Part 53 of this subchapter. Boilers of this type, the maximum allowable pressure of which exceeds 30 pounds per square inch, shall conform to the requirements specified in this subchapter for main boilers.

**§ 52.01–40 Materials and workmanship.**

All materials to be used in any of the work specified in the various sections of this part shall be free from injurious defects and shall have a workmanlike finish. The construction work shall be executed in a workmanlike manner with proper tools or equipment and shall be free from defects which would impair strength or durability.

**§ 52.01–50 Boilers or pressure vessels of foreign vessels.**

(a) Boilers or pressure vessels of foreign vessels admitted to American registry shall be inspected in the same manner as boilers on American vessels. The hydrostatic test of such boilers or pressure vessels shall be one and one-half times the maximum allowable pressure under which they have been operated at the first United States inspection.

(b) This allowable pressure shall be accepted as the basis for determining the maximum allowable pressure where it is not practicable or possible to secure a record of the tests of the plates that entered into the construction of the boiler or pressure vessel. The Officer in Charge, Marine Inspection, may reduce the maximum allowable pressure if deemed necessary after a close examination of the general conditions or design of the boiler or pressure vessel.

**§ 52.01–55 Request for increase in pressure.**

(a) When the maximum allowable pressure of a boiler has been established, an increase in pressure shall not be granted unless the boiler design meets the requirements of this subchapter in effect at the time the boiler was contracted for or built; but in no case will a pressure increase be authorized for boilers constructed prior to the effective date of the regulations dated November 19, 1952, if the minimum thickness found by actual measurements shows that the boiler will have a factor of safety of less than 4½. The piping system, machinery, and appurtenances shall meet the present requirements of this subchapter for the maximum allowable pressure requested. An increase in pressure shall be granted only by the Commandant upon presentation of data or drawings proving that the requested increase in pressure is justified.

(b) When existing boilers are replaced by new boilers designed to operate at pressures in excess of the pressure allowed by the certificate of inspection, an increase in pressure shall not be authorized unless the boiler design, piping systems and machinery meet the requirements of this subchapter for the maximum pressure requested. An increase in maximum allowable pressure shall be granted only by the Commandant upon presentation of data or drawings proving that the boiler, piping system and machinery will operate safely at the desired maximum pressure of the system.

**§ 52.01–60 Alternative materials or methods of construction.**

If, in the development of industrial arts, improved materials or methods of construction are developed, their use in lieu of those specified will be given consideration upon formal application to the Commandant, with full information as to their characteristics, together with such scientific data and evidence as may be necessary to establish the suitability of such materials or methods of construction for the purpose intended.

**§ 52.01–70 Experimental determination of pressure rating.**

(a) Where approval is requested for a boiler structure, pressure vessel or any part thereof which, due to its irregular form, process of manufacture, or for any other reason, becomes a new or difficult subject of accurate mathematical analysis, the Commandant may require a full size specimen to be furnished for the purpose of making any tests which he may consider necessary to determine a safe and fair pressure rating for such pressure vessel or pressure part.

(b) In lieu of the proof hydrostatic tests as prescribed in Subpart 61.35 of this subchapter, the Commandant may permit the use of empirical formulas for determining the maximum allowable pressure of pressure vessels of irregular form, or where the stresses cannot be accurately determined. The empirical formulas shall be based upon proof hydrostatic test data acceptable to the Commandant.

**§ 52.01–75 Inspectors' decisions.**

When it becomes necessary for inspectors to make decisions on certain matters covered by the regulations in this subchapter, they shall in making their reports quote the section and paragraph number on which their decisions are based. Whenever it is necessary to make decisions in matters not specifically covered by the regulations in this subchapter, they shall in making their reports state clearly the reasons which caused them to arrive at such decisions.

**§ 52.01–85 Alternative procedures to govern new designs or methods of construction.**

When new procedures, designs, or methods of construction are submitted for approval, the Commandant is authorized to act regarding the approval or disapproval of such new developments for which no regulations have been provided.

## Subpart 52.05—Cylindrical Shells

**§ 52.05–1 Definitions.**

(a) *Cylindrical shell.* The term "cylindrical shell," as used in the regulations in this subchapter means the cylinder forming the outer envelope of a boiler or other pressure vessel, or of a drum which is a part of a boiler consisting of one or more plates properly riveted, welded, or otherwise joined or of seamless construction as hereinafter specified. (This does not include curved tube sheets set forth in Subpart 52.40.)

(b) *Course.* A course is a section of a cylindrical shell which comes between circumferential joints.

**§ 52.05–5 Materials.**

(a) Plates shall be of marine boiler steel complying with subpart 51.04 of this subchapter, except that boilers designed for pressures not exceeding 150 pounds per square inch may be constructed of steel meeting the specifications of subpart 51.22 of this subchapter, and which are tested, inspected, and stamped in conformance with the requirements for class A materials.

(b) Boiler shells not exceeding 24 inches in diameter may be of seamless pipe or tubing in accordance with requirements of § 52.05–15. Boiler shells not exceeding 18 inches in diameter may be fabricated of electric-resistance butt-welded pipe in accordance with § 52.05–20.

**§ 52.05–10 Computations.**

(a)(1) *General.* The maximum allowable pressure and the minimum thickness of cylindrical shells subject to internal pressure shall be determined by the strength of the weakest course computed from the thickness and tensility of the material, the efficiency of the longitudinal joint, or of the ligament efficiency between the tube holes in the shell or drum (whichever is the least), the inside or outside radius of the course, and the maximum allowable stress.

(2) *Boiler shells.* (i) Cylindrical headers and drums up to and including 24 inches in outside diameter shall be computed in accordance with Formula (3).

(ii) Cylindrical shells larger than 24 inches in outside diameter, where the thickness of the shell does not exceed one-half of the inside radius, and the designed temperature does not exceed 900° F., Formula (1) shall be used. Where the thickness exceeds one-half of the inside radius, and for temperatures up to that of saturated steam at critical pressure (705.4° F.), Formula (2) shall be used.

(iii) The minimum thickness of boiler plates shall not be less than ¼ inch where the diameter of the shell is 36

inches and under and shall not be less than 5/16 inch when the diameter is over 36 inches and not greater than 54 inches, and not less than 3/8 inch for shell diameter exceeding 54 inches but not greater than 72 inches.

$$P=\frac{STE}{R+0.6T} \text{ or } T=\frac{PR}{SE-0.6P} \quad (1)$$

$$P=SE\left(\frac{R_o^2-R^2}{R_o^2+R^2}\right) \quad (2)$$

$$P=\frac{SE}{\frac{D}{2T}-y} \text{ or } T=\frac{PD}{2SE+2yP} \quad (3)$$

Where:

$P$ = maximum allowable pressure, in pounds per square inch. The value of $P$ in formula (3) shall not be taken as less than 100 p.s.i. for any condition of service or material.

$S$ = maximum allowable stress, in pounds per square inch, taken from Tables 52.05-10(a) and 54.03-10(c) and subject to the limitations of § 52.05-12.

$T$ = minimum thickness of the shell plates, in inches.

$R$ = inside radius of the shell, in inches.

$R_o$ = outside radius of the shell, in inches.

$D$ = outside diameter of header or drum, in inches.

$E$ = minimum efficiency of the longitudinal joints or of ligaments between tube holes or other openings.

$y$ = a coefficient having values as follows:

| Materials | Temperature, ° F. | | | | | |
|---|---|---|---|---|---|---|
| | 900 and below | 950 | 1,000 | 1,050 | 1,100 | 1,150 and above |
| Ferritic steels | 0.4 | 0.5 | 0.7 | 0.7 | 0.7 | 0.7 |
| Austenitic steels | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | 0.7 |

TABLE 52.05-10(a)—MAXIMUM ALLOWABLE STRESSES [1] FOR FERROUS MATERIALS

| Specification subpart | A.S.T.M. designation | Grade | | Minimum tensile strength p.s.i. | Notes | For metal temperatures not exceeding °F.[2] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A.S.T.M. | C.G. | | | 650 | 700 | 750 | 800 | 850 | 900 | 950 | 1,000 | 1,050 | 1,100 | 1,150 | 1,200 |
| PLATE | | | | | | | | | | | | | | | | | |
| Carbon steel: | | | | | | | | | | | | | | | | | |
| 51.04 | A201 | A | A | 55,000 | | 13,750 | 13,250 | 12,050 | 10,200 | | | | | | | | |
| 51.04 | A201 | B | B | 60,000 | | 15,000 | 14,350 | 12,950 | 10,800 | | | | | | | | |
| 51.04 | A212 | A | C | 65,000 | | 16,250 | 15,500 | 13,850 | 11,400 | | | | | | | | |
| 51.04 | A212 | B | D | 70,000 | | 17,500 | 16,600 | 14,750 | 12,000 | | | | | | | | |
| 51.22 | A285 | A | A | 45,000 | | 11,250 | | | | | | | | | | | |
| 51.22 | A285 | B | B | 50,000 | | 12,500 | | | | | | | | | | | |
| 51.22 | A285 | C | C | 55,000 | | 13,750 | | | | | | | | | | | |
| Alloy steel: | | | | | | | | | | | | | | | | | |
| 51.04 | A202 | A | A | 75,000 | | 18,750 | 17,700 | 15,650 | 12,600 | | | | | | | | |
| 51.04 | A203 | A, D | A, D | 65,000 | | 16,250 | 15,500 | 13,850 | 11,400 | | | | | | | | |
| 51.04 | A203 | B, E | B, E | 70,000 | | 17,500 | 16,600 | 14,750 | 12,000 | | | | | | | | |
| 51.04 | A204 | A | E | 65,000 | (3) | 16,250 | 16,250 | 16,250 | 15,650 | 14,400 | 12,500 | | | | | | |
| 51.04 | A204 | B | F | 70,000 | (3) | 17,500 | 17,500 | 17,500 | 16,900 | 15,000 | 12,750 | | | | | | |
| 51.04 | A204 | C | G | 75,000 | (3) | 18,750 | 18,750 | 18,750 | 18,000 | 15,900 | 13,000 | | | | | | |
| 51.04 | A225 | A | A | 70,000 | | 17,500 | 16,600 | 14,750 | 12,000 | | | | | | | | |
| 51.04 | A225 | B | B | 75,000 | | 18,750 | 17,700 | 15,650 | 12,000 | | | | | | | | |
| 51.04 | A299 | | A | 75,000 | | 18,750 | 17,700 | 15,650 | 12,000 | | | | | | | | |
| 51.04 | A302 | A | A | 75,000 | (3) | 18,750 | 18,750 | 18,750 | 18,000 | 15,900 | 13,000 | | | | | | |
| 51.04 | A302 | B | B | 80,000 | (3) | 20,000 | 20,000 | 20,000 | 19,100 | 16,800 | 13,250 | | | | | | |
| 51.04 | A353 | A and B | A and B | 90,000 | | 22,500 | | | | | | | | | | | |
| 51.04 | A357 | | A | 60,000 | | 13,700 | 13,400 | 13,100 | 12,800 | 12,400 | 11,500 | 10,000 | 7,300 | 5,200 | | | |
| 51.04 | A387 | A | A | 65,000 | (4) | 16,250 | 16,250 | 16,250 | 15,650 | 14,400 | 12,500 | 10,000 | | | | | |
| 51.04 | A387 | B | B | 60,000 | (4) | 15,000 | 15,000 | 15,000 | 14,750 | 14,200 | 13,100 | 11,000 | 7,500 | 5,000 | | | |
| 51.04 | A387 | C,D | C,D | 60,000 | (4) | 15,000 | 15,000 | 15,000 | 15,000 | 14,400 | 13,100 | 11,000 | 7,800 | 5,800 | | | |
| 51.04 | A387 | E | E | 60,000 | (4) | 15,000 | 14,800 | 14,500 | 13,900 | 13,200 | 12,000 | 9,000 | 7,000 | 5,500 | | | |
| 51.22 | A410 | | | 60,000 | | 15,000 | | | | | | | | | | | |
| High alloy steel: | | | | | | | | | | | | | | | | | |
| 51.23 | A240 | 302 | 302 | 75,000 | (4 5) | 11,200 | 10,800 | 10,400 | | | | | | | | | |
| 51.23 | A240 | 304 | 304 | 75,000 | (4 5) | 11,200 | 10,800 | 10,400 | 10,000 | 9,700 | 9,400 | 9,100 | 8,800 | 8,500 | 7,500 | 5,750 | 4,500 |
| 51.23 | A240 | 304L | 304L | 70,000 | (5) | 8,700 | 8,500 | 8,300 | 8,100 | | | | | | | | |
| 51.23 | A240 | 309S | 309S | 75,000 | (4 5) | 16,450 | 16,400 | 16,200 | 15,700 | 14,900 | 13,800 | 12,500 | 10,500 | 8,500 | 6,500 | 5,000 | 3,800 |
| 51.23 | A240 | 310S | 310S | 75,000 | (4 5) | 16,900 | 16,600 | 16,250 | 15,700 | 14,900 | 13,800 | 12,500 | 11,000 | 7,100 | 5,000 | 3,600 | 2,500 |
| 51.23 | A240 | 316 | 316 | 75,000 | (4 5) | 17,050 | 17,000 | 16,900 | 16,750 | 16,500 | 16,000 | 15,100 | 14,000 | 12,200 | 10,400 | 8,500 | 6,800 |
| 51.23 | A240 | 316L | 316L | 70,000 | (5) | 9,800 | 9,450 | 9,100 | 8,800 | 8,500 | | | | | | | |
| 51.23 | A240 | 317 | 317 | 75,000 | (4 5) | 17,050 | 17,000 | 16,900 | 16,750 | 16,500 | 16,000 | 15,100 | 14,000 | 12,200 | 10,400 | 8,500 | 6,800 |
| 51.23 | A240 | 321 | 321 | 75,000 | (4 5) | 14,850 | 14,800 | 14,700 | 14,450 | 14,300 | 14,100 | 13,850 | 13,500 | 13,100 | 12,500 | 8,500 | 6,800 |
| 51.23 | A240 | 347 | 347 | 75,000 | (4 5) | 14,850 | 14,800 | 14,700 | 14,450 | 14,300 | 14,100 | 13,850 | 13,500 | 13,100 | 12,500 | 8,500 | 6,800 |
| 51.23 | A240 | 348 | 348 | 75,000 | (4 5) | 14,850 | 14,800 | 14,700 | 14,450 | 14,300 | 14,100 | 13,850 | 13,500 | 13,100 | 12,500 | 8,500 | 6,800 |
| 51.23 | A240 | 405 | 405 | 60,000 | (5) | 13,000 | 12,450 | 11,800 | 11,000 | 10,100 | 9,100 | 8,000 | 4,000 | | | | |
| 51.23 | A240 | 410 | 410 | 65,000 | (5) | 13,700 | 13,400 | 13,100 | 12,750 | 12,100 | 11,000 | 8,800 | 6,400 | 4,400 | | | |
| 51.23 | A240 | 410S | 410S | 60,000 | (5) | 12,700 | 12,500 | 12,250 | 11,950 | 11,600 | 11,000 | 8,800 | 6,400 | 4,400 | | | |
| 51.23 | A240 | 430A | 430A | 65,000 | (5) | 13,250 | 12,900 | 12,500 | 12,050 | 11,500 | 10,800 | 9,200 | 6,500 | 4,500 | | | |
| 51.23 | A240 | 430B | 430B | 65,000 | (5) | 13,250 | 12,900 | 12,500 | 12,050 | 11,500 | 10,800 | 9,200 | 6,500 | 4,500 | | | |
| PIPES AND TUBES | | | | | | | | | | | | | | | | | |
| Seamless carbon steel: | | | | | | | | | | | | | | | | | |
| 51.25 | A83 | | T83 | (47,000) | (5) | 11,750 | 11,450 | 10,550 | | | | | | | | | |
| 51.25 | A192 | | T192 | (47,000) | (5) | 11,750 | 11,450 | 10,550 | 9,000 | | | | | | | | |
| 51.25 | A210 | | T210 | 60,000 | | 15,000 | 14,350 | 12,950 | 10,800 | | | | | | | | |
| 51.25 | A179 | | T179 | (47,000) | (5 7) | 11,750 | 11,450 | 10,550 | | | | | | | | | |
| 51.34 | A53 | A | P53-A | 48,000 | | 12,000 | 11,650 | 10,700 | | | | | | | | | |
| 51.34 | A53 | B | P53-B | 60,000 | | 15,000 | 14,350 | 12,950 | | | | | | | | | |
| 51.34 | A106 | A | P106-A | 48,000 | | 12,000 | 11,650 | 10,700 | 9,000 | | | | | | | | |
| 51.34 | A106 | B | P106-B | 60,000 | | 15,000 | 14,350 | 12,950 | 10,800 | | | | | | | | |
| 51.34 | A106 | C | P106-C | 70,000 | (5) | 17,500 | 16,600 | 14,750 | 12,000 | | | | | | | | |
| Seamless alloy steel: | | | | | | | | | | | | | | | | | |
| 51.25 | A209 | T1 | T1 | 55,000 | (5) | 13,750 | 13,750 | 13,750 | 13,450 | 13,150 | 12,500 | | | | | | |
| 51.25 | A209 | T1a | T1a | 60,000 | (5) | 15,000 | 15,000 | 15,000 | 14,400 | 13,750 | 12,500 | | | | | | |
| 51.25 | A209 | T1b | T1b | 53,000 | (5) | 13,250 | 13,250 | 13,250 | 13,000 | 12,750 | 12,500 | | | | | | |
| 51.25 | A213 | T2 | T2 | 60,000 | | 15,000 | 15,000 | 15,000 | 14,400 | 13,750 | 12,500 | 10,000 | 6,500 | | | | |
| 51.25 | A213 | T5 | T5 | 60,000 | (10) | | 13,400 | 13,100 | 12,800 | 12,400 | 11,500 | 10,000 | 7,300 | 5,200 | | | |
| 51.25 | A213 | T5b | T5b | 60,000 | (5) | 13,700 | 13,400 | 13,100 | 12,800 | 12,400 | 10,900 | 9,000 | 5,500 | 3,500 | | | |
| 51.25 | A213 | T7 | T7 | 60,000 | (5) | 13,700 | 13,400 | 13,100 | 12,500 | 11,500 | 9,500 | 7,000 | 5,000 | 3,500 | | | |
| 51.25 | A213 | T9 | T9 | 60,000 | (5) | 13,700 | 13,400 | 13,100 | 12,800 | 12,500 | 12,000 | 10,800 | 8,500 | 5,500 | | | |
| 51.25 | A213 | T11 | T11 | 60,000 | | 15,000 | 15,000 | 15,000 | 15,000 | 14,400 | 13,100 | 11,000 | 7,800 | 5,500 | | | |
| 51.25 | A213 | T12 | T12 | 60,000 | | 15,000 | 15,000 | 15,000 | 14,750 | 14,200 | 13,100 | 11,000 | 7,500 | 5,000 | | | |
| 51.25 | A213 | T17 | T17 | 60,000 | (11) | 15,000 | | | | | | | | | | | |
| 51.25 | A213 | T21 | T21 | 60,000 | | 15,000 | 14,800 | 14,500 | 13,900 | 13,200 | 12,000 | 9,000 | 7,000 | 5,500 | | | |
| 51.25 | A213 | T22 | T22 | 60,000 | | 15,000 | 15,000 | 15,000 | 15,000 | 14,400 | 13,100 | 11,000 | 7,800 | 5,800 | | | |
| 51.25 | A213 | TP304 | T304 | 75,000 | (4 5) | 11,200 | 10,800 | 10,400 | 10,000 | 9,700 | 9,400 | 9,100 | 8,800 | 8,500 | 7,500 | 5,750 | 4,500 |
| 51.25 | A213 | TP304L | T304L | 70,000 | (5) | 8,750 | 8,500 | 8,300 | 8,100 | | | | | | | | |
| 51.25 | A213 | TP310 | T310 | 75,000 | (5) | 16,900 | 16,600 | 16,750 | 15,700 | 14,900 | 13,800 | 12,500 | 11,000 | 7,100 | 5,000 | 3,600 | 2,500 |
| 51.25 | A213 | TP316 | T316 | 75,000 | (4 5) | 17,050 | 17,000 | 16,900 | 16,750 | 16,500 | 16,000 | 15,100 | 14,000 | 12,200 | 10,400 | 8,500 | 6,800 |
| 51.25 | A213 | TP316L | T316L | 70,000 | (5) | 9,800 | 9,450 | 9,100 | 8,800 | 8,500 | | | | | | | |
| 51.25 | A213 | TP321 | T321 | 75,000 | (4 5) | 14,850 | 14,800 | 14,700 | 14,550 | 14,300 | 14,100 | 13,850 | 13,500 | | | | |

See footnotes at end of table.

TABLE 52.05-10(a)—MAXIMUM ALLOWABLE STRESSES [1] FOR FERROUS MATERIALS—Continued

| Specification subpart | A.S.T.M. designation | Grade | | Minimum tensile strength p.s.i. | Notes | For metal temperatures not exceeding °F.[2] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A.S.T.M. | C.G. | | | 650 | 700 | 750 | [illegible] | 850 | 900 | 950 | 1,000 | 1,050 | 1,100 | 1,150 | 1,200 |
| PIPES AND TUBES—continued | | | | | | | | | | | | | | | | | |
| Seamless alloy steel—Con. | | | | | | | | | | | | | | | | | |
| 51.25 | A213 | TP321H | T321H | 75,000 | (4 8) | 14,850 | 14,800 | 14,700 | 14,550 | 14,300 | 14,100 | 13,850 | 13,500 | 13,100 | 12,500 | 8,000 | 5,000 |
| 51.25 | A213 | TP347 | T347 | 75,000 | (4 8) | 14,850 | 14,800 | 14,700 | 14,550 | 14,300 | 14,100 | 13,850 | 13,500 | 13,100 | 12,500 | 8,000 | 5,000 |
| 51.25 | A213 | TP348 | T348 | 75,000 | (4 8) | 14,850 | 14,800 | 14,700 | 14,550 | 14,300 | 14,100 | 13,850 | 13,500 | 13,100 | 12,500 | 8,000 | 5,000 |
| 51.25 | A423 | | | 60,000 | | 15,000 | | | | | | | | | | | |
| 51.34 | A312 | TP304 | P304 | 75,000 | (4 8) | 11,200 | 10,800 | 10,400 | 10,000 | 9,700 | 9,400 | 9,100 | 8,800 | 8,500 | 7,500 | 5,750 | 4,500 |
| 51.34 | A312 | TP304L | P304L | 70,000 | (8) | 8,750 | 8,500 | 8,300 | 8,100 | | | | | | | | |
| 51.34 | A312 | TP309 | P309 | 75,000 | (4 8) | 16,450 | 16,400 | 16,200 | 15,700 | 14,900 | 13,800 | 12,500 | 10,500 | 8,500 | 6,500 | 5,000 | 3,800 |
| 51.34 | A312 | TP310 | P310 | 75,000 | (4 8) | 16,900 | 16,600 | 16,250 | 15,700 | 14,900 | 13,800 | 12,500 | 11,000 | 7,100 | 5,000 | 3,800 | 2,500 |
| 51.34 | A312 | TP316 | P316 | 75,000 | (4 8) | 17,050 | 17,000 | 16,900 | 16,750 | 16,500 | 16,000 | 15,100 | 14,000 | 12,200 | 10,400 | 8,500 | 6,800 |
| 51.34 | A312 | TP316L | P316L | 70,000 | (8) | 9,800 | 9,450 | 9,100 | 8,800 | 8,500 | | | | | | | |
| 51.34 | A312 | TP317 | P317 | 75,000 | (4 8) | 17,050 | 17,000 | 16,900 | 16,750 | 16,500 | 16,000 | 15,100 | 14,000 | 12,200 | 10,400 | 8,500 | 6,800 |
| 51.34 | A312 | TP321 | P321 | 75,000 | (4 8) | 14,850 | 14,800 | 14,700 | 14,550 | 14,300 | 14,100 | 13,850 | 13,500 | 13,100 | 12,500 | 8,000 | 5,000 |
| 51.34 | A312 | TP347 | P347 | 75,000 | (4 8) | 14,850 | 14,800 | 14,700 | 14,550 | 14,300 | 14,100 | 13,850 | 13,500 | 13,100 | 12,500 | 8,000 | 5,000 |
| 51.34 | A312 | TP348 | P348 | 75,000 | (4 8) | 14,850 | 14,800 | 14,700 | 14,550 | 14,300 | 14,100 | 13,850 | 13,500 | 13,100 | 12,500 | 8,000 | 5,000 |
| 51.34 | A335 | P1 | P1 | 55,000 | (9) | 13,750 | 13,750 | 13,750 | 13,450 | 13,150 | 12,500 | | | | | | |
| 51.34 | A335 | P2 | P2 | 55,000 | | 13,750 | 13,750 | 13,750 | 13,450 | 13,150 | 12,500 | 10,000 | 6,250 | | | | |
| 51.34 | A335 | P5 | P5 | 60,000 | (6) | 13,700 | 13,400 | 13,100 | 12,800 | 12,400 | 11,500 | 10,000 | 7,300 | 5,200 | | | |
| 51.34 | A335 | P5c | P5c | 60,000 | (6) | 13,700 | 13,400 | 13,100 | 12,800 | 12,400 | 11,500 | 10,000 | 7,300 | 4,800 | | | |
| 51.34 | A335 | P7 | P7 | 60,000 | (6) | 13,700 | 13,400 | 13,100 | 12,500 | 11,500 | 9,500 | 7,000 | 5,000 | 3,500 | | | |
| 51.34 | A335 | P9 | P9 | 60,000 | (6) | 13,700 | 13,400 | 13,100 | 12,800 | 12,500 | 12,000 | 10,800 | 8,500 | 5,500 | | | |
| 51.34 | A335 | P11 | P11 | 60,000 | | 15,000 | 15,000 | 15,000 | 15,000 | 14,400 | 13,100 | 11,000 | 7,800 | 5,500 | | | |
| 51.34 | A335 | P12 | P12 | 60,000 | | 15,000 | 15,000 | 15,000 | 14,750 | 14,200 | 13,100 | 11,000 | 7,500 | 5,000 | | | |
| 51.34 | A335 | P15 | P15 | 60,000 | | 15,000 | 15,000 | 15,000 | 14,400 | 13,750 | 12,500 | 10,000 | 6,250 | | | | |
| 51.34 | A335 | P21 | P21 | 60,000 | | 15,000 | 14,800 | 14,500 | 13,900 | 13,200 | 12,000 | 9,000 | 7,500 | 5,800 | | | |
| 51.34 | A335 | P22 | P22 | 60,000 | | 15,000 | 15,000 | 15,000 | 15,000 | 14,400 | 13,100 | 11,000 | 7,800 | 5,800 | | | |
| Electric-resistance-welded pipe: | | | | | | | | | | | | | | | | | |
| 51.25 | A178 | A | T178-A | (47,000) | (6 12 13) | 10,000 | 9,700 | 8,950 | | | | | | | | | |
| 51.25 | A178 | C | T178-C | 60,000 | (12 13) | 12,750 | 12,200 | 11,000 | | | | | | | | | |
| 51.25 | A226 | | T226 | 47,000 | (5 12 13) | 10,000 | 9,700 | 8,950 | 7,800 | | | | | | | | |
| 51.25 | A250 | T1 | T1-RW | 55,000 | (3 12) | 11,700 | 11,700 | 11,700 | 11,450 | 11,200 | 10,650 | | | | | | |
| 51.25 | A250 | T1a | T1a-RW | 60,000 | (3 12) | 12,750 | 12,750 | 12,750 | 12,750 | 11,700 | 10,650 | | | | | | |
| 51.25 | A250 | T1b | T1b-RW | 53,000 | (3 12) | 11,250 | 11,250 | 11,250 | 11,050 | 10,850 | 10,650 | | | | | | |
| 51.25 | A423 | | T423-RW | 60,000 | (12) | 12,750 | | | | | | | | | | | |
| 51.34 | A53 | A | P53-RW-A | 48,000 | (12) | 10,200 | | | | | | | | | | | |
| 51.34 | A53 | B | P53-RW-B | 60,000 | (12) | 12,750 | | | | | | | | | | | |
| 51.34 | A135 | A | P135-A | 48,000 | (12) | 10,200 | | | | | | | | | | | |
| 51.34 | A135 | B | P135-B | 60,000 | (12) | 12,750 | | | | | | | | | | | |
| 51.34 | A312 | TP304 | P304-RW | 75,000 | (4 5 12) | 9,500 | 9,200 | 8,850 | 8,500 | 8,250 | 8,000 | 7,750 | 7,500 | 7,200 | 6,400 | 4,900 | 3,800 |
| 51.34 | A312 | TP304L | P304L-RW | 75,000 | (5 12) | 7,450 | 7,200 | 7,050 | 6,900 | | | | | | | | |
| 51.34 | A312 | TP309 | P309-RW | 75,000 | (5 12) | 14,000 | 13,950 | 13,800 | 13,350 | 12,700 | 11,700 | 10,600 | 8,900 | 7,200 | 5,500 | 4,250 | 3,250 |
| 51.34 | A312 | TP310 | P310-RW | 75,000 | (4 5 12) | 14,400 | 14,100 | 13,800 | 13,350 | 12,700 | 11,700 | 10,600 | 9,350 | 6,000 | 4,250 | 3,050 | 2,100 |
| 51.34 | A312 | TP316 | P316-RW | 75,000 | (4 5 12) | 14,500 | 14,450 | 14,350 | 14,250 | 14,000 | 13,600 | 12,800 | 11,900 | 10,400 | 8,850 | 7,200 | 5,800 |
| 51.34 | A312 | TP316L | P316L-RW | 70,000 | (5 12) | 8,350 | 8,050 | 7,750 | 7,500 | 7,200 | | | | | | | |
| 51.34 | A312 | TP317 | P317-RW | 75,000 | (4 5 12) | 14,500 | 14,450 | 14,350 | 14,250 | 14,000 | 13,600 | 12,800 | 11,900 | 10,400 | 8,850 | 7,200 | 5,800 |
| 51.34 | A312 | TP321 | P321-RW | 75,000 | (4 5 12) | 12,650 | 12,600 | 12,500 | 12,350 | 12,150 | 12,000 | 11,800 | 11,500 | 11,100 | 10,600 | 6,800 | 4,250 |
| 31.45 | A312 | TP347 | P347-RW | 75,000 | (4 5 12) | 12,650 | 12,600 | 12,500 | 12,350 | 12,150 | 12,000 | 11,800 | 11,500 | 11,100 | 10,600 | 6,800 | 4,250 |
| 31.45 | A312 | TP348 | P348-RW | 75,000 | (4 5 12) | 12,650 | 12,600 | 12,500 | 12,350 | 12,150 | 12,000 | 11,800 | 11,500 | 11,100 | 10,600 | 6,800 | 4,250 |
| FORGINGS | | | | | | | | | | | | | | | | | |
| Carbon steel: | | | | | | | | | | | | | | | | | |
| 51.46 | A105 | I | F105-I | 60,000 | | 15,000 | 14,350 | 12,950 | 10,800 | | | | | | | | |
| 51.46 | A105 | II | F105-II | 70,000 | | 17,500 | 16,600 | 14,750 | 12,000 | | | | | | | | |
| 51.46 | A181 | I | F181-I | 60,000 | | 15,000 | 14,350 | 12,950 | 10,800 | | | | | | | | |
| 51.46 | A181 | II | F181-II | 70,000 | | 17,500 | 16,600 | 14,750 | 12,000 | | | | | | | | |
| Alloy steel: | | | | | | | | | | | | | | | | | |
| 51.46 | A182 | F1 | F1 | 70,000 | (3) | 17,500 | 17,500 | 17,500 | 16,900 | 15,000 | 12,750 | | | | | | |
| 51.46 | A182 | F5 | F5 | 60,000 | (10) | | 13,400 | 13,100 | 12,800 | 12,400 | 11,500 | 10,000 | 7,300 | 5,200 | | | |
| 51.46 | A182 | F5a | F5a | 90,000 | (5) | 19,000 | 17,500 | 16,000 | 14,500 | 13,000 | 11,500 | 10,000 | 7,300 | 5,200 | | | |
| 51.46 | A182 | F6 | F6-410 | 85,000 | (5) | 17,900 | 17,500 | 17,050 | 16,300 | 14,000 | 11,000 | 8,800 | 6,400 | 4,400 | | | |
| 51.46 | A182 | F7 | F7 | 60,000 | (5) | 13,700 | 13,400 | 13,100 | 12,500 | 11,500 | 9,500 | 7,000 | 5,000 | 3,500 | | | |
| 51.46 | A182 | F9 | F9 | 100,000 | (5) | 22,000 | 21,200 | 20,000 | 17,700 | 15,400 | 13,100 | 10,800 | 8,500 | 5,500 | | | |
| 51.46 | A182 | F11 | F11 | 70,000 | (5) | 16,800 | 16,150 | 15,500 | 15,000 | 14,400 | 13,100 | 11,000 | 7,800 | 5,500 | | | |
| 51.46 | A182 | F12 | F12 | 70,000 | (10) | 16,800 | 16,150 | 15,500 | 14,850 | 14,200 | 13,100 | 11,000 | 7,500 | 5,000 | | | |
| 51.46 | A182 | F21 | F21 | 70,000 | (5) | 15,600 | 15,100 | 14,600 | 13,900 | 13,200 | 12,000 | 9,000 | 7,800 | 5,500 | | | |
| 51.46 | A182 | F22 | F22 | 70,000 | | 17,500 | 17,500 | 17,500 | 17,500 | 16,000 | 14,000 | 11,000 | 7,800 | 5,800 | | | |
| 51.46 | A182 | F304 | F304 | 75,000 | (4 5) | 11,200 | 10,800 | 10,400 | 10,000 | 9,700 | 9,400 | 9,100 | 8,800 | 8,500 | 7,500 | 5,750 | 4,500 |
| 51.46 | A182 | F304L | F304L | 65,000 | (5) | 8,750 | 8,500 | 8,300 | 8,100 | | | | | | | | |
| 51.46 | A182 | F310 | F310 | 95,000 | (4 5) | 16,900 | 16,600 | 16,250 | 15,700 | 14,900 | 13,800 | 12,500 | 11,000 | 7,100 | 5,000 | 3,600 | 2,500 |
| 51.46 | A182 | F316 | F316 | 75,000 | (4 5) | 17,050 | 17,000 | 16,900 | 16,750 | 16,500 | 16,000 | 15,100 | 14,000 | 12,200 | 10,400 | 8,500 | 6,800 |
| 51.46 | A182 | F316L | F316L | 65,000 | (5) | 9,800 | 9,450 | 9,100 | 8,800 | 8,500 | | | | | | | |
| 51.46 | A182 | F321 | F321 | 75,000 | (4 5) | 14,850 | 14,800 | 14,700 | 14,550 | 14,300 | 14,100 | 13,850 | 13,500 | 13,100 | 12,500 | 8,000 | 5,000 |
| 51.46 | A182 | F347 | F347 | 75,000 | (4 5) | 14,850 | 14,800 | 14,700 | 14,550 | 14,300 | 14,100 | 13,850 | 13,500 | 13,100 | 12,500 | 8,000 | 5,000 |
| 51.46 | A182 | F348 | F348 | 75,000 | (4 5) | 14,850 | 14,800 | 14,700 | 14,550 | 14,300 | 14,100 | 13,850 | 13,500 | 13,100 | 12,500 | 8,000 | 5,000 |
| 51.46 | A336 | F1 | F1 | 70,000 | (3) | 17,500 | 17,500 | 17,500 | 16,900 | 15,000 | 12,750 | | | | | | |
| 51.46 | A336 | F2 | F2 | 70,000 | (5 14) | 16,800 | 16,150 | 15,500 | 14,850 | 14,200 | 13,100 | 11,000 | 7,500 | 5,000 | | | |
| 51.46 | A336 | F5 | F5 | 60,000 | (5 14) | 13,700 | 13,400 | 13,100 | 12,800 | 12,400 | 11,500 | 10,000 | 7,300 | 5,200 | | | |
| 51.46 | A336 | F5a | F5a | 80,000 | (5 14) | 17,300 | 16,500 | 15,500 | 14,500 | 13,000 | 11,500 | 10,000 | 7,300 | 5,200 | | | |
| 51.46 | A336 | F6 | F6-410 | 75,000 | (5) | 15,700 | 15,400 | 15,100 | 14,650 | 14,000 | 11,000 | 8,800 | 6,400 | 4,400 | | | |
| 51.46 | A336 | F22 | F22 | 70,000 | (14) | 17,500 | 17,500 | 17,500 | 17,500 | 16,000 | 14,000 | 11,000 | 7,800 | 5,800 | | | |
| 51.46 | A336 | F8 | F8-304 | 75,000 | (4 5) | 11,200 | 10,800 | 10,400 | 10,000 | 9,700 | 9,400 | 9,100 | 8,800 | 8,500 | 7,500 | 5,750 | 4,500 |
| 51.46 | A336 | F8m | F8m-316 | 75,000 | (4 5) | 17,050 | 17,000 | 16,900 | 16,750 | 16,500 | 16,000 | 15,100 | 14,000 | 12,200 | 10,400 | 8,500 | 6,800 |
| 51.46 | A336 | F8c | F8c-347 | 75,000 | (4 5) | 14,850 | 14,800 | 14,700 | 14,550 | 14,300 | 14,100 | 13,850 | 13,500 | 13,100 | 12,500 | 8,000 | 5,000 |
| 51.46 | A336 | F8t | F8t-321 | 75,000 | (4 5) | 14,850 | 14,800 | 14,700 | 14,550 | 14,300 | 14,100 | 13,850 | 13,500 | 13,100 | 12,500 | 8,000 | 5,000 |
| 51.46 | A336 | F25 | F25-310 | 95,000 | (4 5) | 20,850 | 20,000 | 18,500 | 17,000 | 15,500 | 14,000 | 12,500 | 11,000 | 9,750 | 8,500 | 7,250 | 6,000 |

See footnotes at end of table.

TABLE 52.05-10(a)—MAXIMUM ALLOWABLE STRESSES [1] FOR FERROUS MATERIALS—Continued

| Specification subpart | A.S.T.M. designation | Grade | | Minimum tensile strength p.s.i. | Notes | For metal temperatures not exceeding °F. [2] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A.S.T.M. | C.G. | | | 650 | 700 | 750 | 800 | 850 | 900 | 950 | 1,000 | 1,050 | 1,100 | 1,150 | 1,200 |
| BOLTING | | | | | | | | | | | | | | | | | |
| Carbon steel: | | | | | | | | | | | | | | | | | |
| 51.49 | A307 | | B | 55,000 | (16) | 7,000 | | | | | | | | | | | |
| Alloy steel: | | | | | | | | | | | | | | | | | |
| 51.49 | A193 | B5 | B5 | | (16) | 20,000 | 20,000 | 20,000 | 20,000 | 17,250 | 13,750 | 10,300 | 7,300 | | | | |
| 51.49 | A193 | B6 | B6 | | (16) | 20,000 | 18,400 | 16,700 | 14,300 | 11,800 | 8,400 | | | | | | |
| 51.49 | A193 | B7 | B7 | | (16) | 20,000 | 20,000 | 20,000 | 20,000 | 16,250 | 12,500 | | | | | | |
| 51.49 | A193 | B14 | B14 | | (16) | 20,000 | 20,000 | 20,000 | 20,000 | 18,750 | 16,650 | 14,250 | 11,000 | 6,250 | | | |
| 51.49 | A193 | B16 | B16 | | (16) | 20,000 | 20,000 | 20,000 | 20,000 | 18,750 | 16,650 | 14,250 | 11,000 | 6,250 | | | |
| 51.49 | A193 | B8C | B8C | | | 11,850 | 11,800 | 11,750 | 11,650 | 11,450 | 11,300 | 11,100 | 10,800 | 10,500 | 10,000 | 8,000 | 5,000 |
| 51.49 | A193 | B8T | B8T | | | 11,850 | 11,800 | 11,750 | 11,650 | 11,450 | 11,300 | 11,100 | 10,800 | 10,500 | 10,000 | 8,000 | 5,000 |
| CASTINGS | | | | | | | | | | | | | | | | | |
| Carbon steel: | | | | | | | | | | | | | | | | | |
| 51.58 | A216 | WCA | WCA | 60,000 | (17) | 15,000 | 14,350 | 12,950 | 10,800 | | | | | | | | |
| 51.58 | A216 | WCB | WCB | 70,000 | (17) | 17,500 | 16,600 | 14,750 | 12,000 | | | | | | | | |
| Alloy steel: | | | | | | | | | | | | | | | | | |
| 51.58 | A217 | WC1 | WC1 | 65,000 | (3 17 18) | 16,250 | 16,250 | 16,250 | 15,650 | 14,400 | 12,500 | | | | | | |
| 51.58 | A217 | WC4 | WC4 | 70,000 | (17 18) | 17,500 | 17,500 | 17,500 | 17,000 | 15,800 | 14,000 | | | | | | |
| 51.58 | A217 | WC5 | WC5 | 70,000 | (17 18) | 17,500 | 17,500 | 17,500 | 17,000 | 15,800 | 14,000 | 11,000 | 7,800 | 5,500 | | | |
| 51.58 | A217 | WC6 | WC6 | 70,000 | (17 18) | 17,500 | 17,500 | 17,500 | 17,000 | 15,800 | 14,000 | 11,000 | 7,800 | | | | |
| 51.58 | A217 | WC9 | WC9 | 70,000 | (17 18) | 17,500 | 17,500 | 17,500 | 17,000 | 15,800 | 14,000 | 11,000 | 7,800 | 5,800 | | | |
| 51.58 | A217 | C5 | C5 | 90,000 | (17) | 22,500 | 21,600 | 20,400 | 19,000 | 17,000 | 13,600 | 10,000 | 7,300 | | | | |
| 51.58 | A217 | C12 | C12 | 90,000 | (17) | 22,500 | 22,000 | 21,000 | 19,400 | 17,300 | 15,000 | 11,750 | 8,500 | | | | |
| 51.58 | A351 | CA15 | CA15 | 90,000 | (17) | 21,600 | 20,700 | 19,600 | 18,300 | 16,000 | 11,000 | 7,600 | 5,000 | 3,300 | 2,200 | 1,500 | 1,000 |
| 51.58 | A351 | CF8 | CF8 | 70,000 | (4 8 17) | 11,500 | 11,300 | 11,100 | 10,900 | 10,650 | 10,400 | 10,100 | 9,850 | 9,600 | 7,500 | 5,700 | 4,500 |
| 51.58 | A351 | CF8M | CF8M | 70,000 | (4 8 17) | 15,000 | 14,700 | 14,350 | 14,000 | 13,500 | 13,000 | 12,350 | 11,700 | 10,600 | 9,400 | 8,000 | 6,800 |
| 51.58 | A351 | CF8C | CF8C | 70,000 | (4 8 17) | 11,900 | 11,700 | 11,600 | 11,500 | 11,350 | 11,200 | 11,100 | 11,000 | 10,900 | 10,800 | 8,000 | 5,000 |
| 51.58 | A351 | CH20 | CH20 | 70,000 | (4 8 17) | 14,400 | 14,350 | 14,300 | 14,150 | 13,900 | 13,500 | 12,500 | 10,500 | 8,500 | 6,500 | 5,000 | 3,800 |
| 51.58 | A351 | CK20 | CK20 | 65,000 | (4 8 17) | 14,400 | 14,350 | 14,300 | 14,150 | 13,900 | 13,500 | 12,500 | 11,000 | 9,750 | 8,500 | 7,250 | 6,000 |

[1] In general, the allowable "S" values in Table 52.05-10(a) except for welded pipe and tubing, and bolting, are based on one-fourth of the minimum of the specified tensile range of the material for temperatures of 650° and below; and on creep stress or stress-rupture for temperatures above 650° F.

[2] Intermediate values of "S" may be obtained by interpolation.

[3] Carbon-molybdenum alloy-steel plate, pipe, forging, and cast material shall be limited to a maximum temperature of 875° F.

[4] These stress values apply only when carbon content is 0.04 percent or higher.

[5] Higher values of maximum allowable stress for temperatures between 0° F. and 650° F. will be considered based on the proposed application.

[6] The minimum tensile strength employed not given in the specification; tensile strength value assumed.

[7] Permitted only for use as tube material in heat exchangers and tubing for hydraulic systems.

[8] This material limited to the construction of superheater, waterwall and economiser headers when used in boilers. Where welding fabrication is employed, a minimum preheat temperature of 300° F. shall be used.

[9] This material shall be limited to a temperature of 875° F. when used in the design of pressure vessels.

[10] Maximum allowable stress values for temperatures below 700° F. are as follows:

| A.S.T.M. designation | Grade | For metal temperatures not exceeding °F. | | | |
|---|---|---|---|---|---|
| | | −20 to 400 | 500 | 600 | 650 |
| A213 | T5 | 15,000 | 14,500 | 14,000 | 13,700 |
| A182 | F12 | 17,500 | 17,500 | 17,500 | 16,800 |
| A182 | F5 | 22,500 | 21,600 | 20,100 | 19,000 |

[11] Maximum allowable stress values for temperatures exceeding 650° F. will be considered based on the proposed application.

[12] These stresses include weld joint efficiency of 0.85.

[13] When material conforming to this specification is used in boiler, waterwall, economizer, and superheater tubes that are fully enclosed within the boiler setting, and in heat exchanger tubes, the maximum allowable stress may be used without weld joint efficiency of 0.85.

[14] Welding or brazing not permitted on liquid quenched and tempered materials.

[15] This stress not permitted for temperatures exceeding 450° F.

[16] Between temperatures of −20° to 400° F., stress values equal to the lower of the following will be permitted; 20 percent of the minimum tensile strength or 25 percent of the minimum yield strength.

[17] To these stresses a quality factor as specified in § 52.05-13 shall be applied.

[18] These stresses apply to the normalized material only.

**§ 52.05-12 Maximum allowable stress.**

(a) The maximum allowable stresses given in Tables 52.05-10 (a) and 54.03-10 (c) in Part 54 of this subchapter may be used in the formulas for determining the maximum allowable pressure and the minimum thickness of seamless or arc-welded shells which do not require staying, unstayed blank hemispherical and ellipsoidal heads with the pressure on the concave side, flat heads which do not require staying, bolting flanges, and reinforced openings in shells and heads of boilers and unfired pressure vessels, provided the fabrication complies with the following requirements:

(1) The pressure parts of boilers shall have a minimum thickness exceeding ½ inch, and to the calculated thickness as determined by the applicable design formula, a corrosion allowance of 0.1 inch shall be added.

(2) The pressure parts of unfired pressure vessels shall have a corrosion allowance of one-sixth of the calculated thickness, or 1/16 inch, whichever is smaller, added to the calculated thickness as determined by the applicable design formula, except that no additional thickness need be provided when acceptable corrosion resistant materials are employed.

(3) Backing strips fitted in way of longitudinal joints shall be removed and the weld surface and reinforcement of longitudinal and circumferential joints shall be prepared in accordance with § 56.05-5 (c) of this subchapter. For cylindrical shells subject to temperatures exceeding 800° F., all weld reinforcement on both the inside and outside of the shell at the longitudinal and circumferential joints shall be removed wherever possible.

(4) Class II welded pressure vessels which are not given a complete radiographic examination shall have portions of the welded joints examined by spot radiography as required by § 56.05-6 of this subchapter.

(5) The stresses due to hydrostatic head shall be taken into account in determining the minimum thickness of the shell or head of any pressure vessel. Additional stresses, imposed by effects other than internal pressure or static head, which increase the average stress over substantial sections of the shell or head by more than 10 percent of the allowable stress shall be taken into account. These effects include the weight of the vessel and its contents, method of support, impact loads, superimposed loads, localized stresses due to the reactions of supports, and stresses due to temperature gradient.

(b) The maximum allowable stress used in the formulas for determining the maximum allowable pressure and minimum thickness of the following pressure parts of boilers and unfired pressure vessels shall not exceed 80 percent of the values given in Tables 52.05–10 (a) and 54.03–10 (c) in Part 54 of this subchapter:

(1) Boiler shell or head thicknesses of ½ inch or less.

(2) Riveted or brazed shells or heads.

(3) Dished heads, other than hemispherical or ellipsoidal.

(4) Unstayed hemispherical or ellipsoidal heads with pressure on the convex side.

(5) Hemispherical and ellipsoidal heads with flanged-in or other unreinforced manholes.

(6) All stays, braces or parts requiring staying.

(c) Where the maximum allowable stress is limited to 80 percent of the values given in Table 52.05–10 (a) or 54.03–10 (c) in Part 54 of this subchapter, compliance with the provisions of paragraph (a) of this section is not required.

**§ 52.05–13 Quality factors for steel castings.**

(a) A quality factor as specified in this section shall be applied to the allowable stresses for steel casting materials as given in Table 52.05–10 (a), when used in special design of pressure parts.

(b) A factor not to exceed 80 percent shall be applied when a casting is produced only in accordance with the material specifications given in Subpart 51.58 of this subchapter.

(c) A factor not to exceed 90 percent may be used for castings which have been radiographed at all critical sections [1] and found free of injurious defects.

(d) Radiographing, where required shall conform to the requirements of § 56.05–5 of this subchapter.

(e) Serious defects shall be the basis for rejection of the casting. Defects which are not considered as impairing the strength of the castings may be repaired by welding in accordance with the applicable requirements of this subchapter for welding repairs to defective carbon-steel or alloy-steel castings.

(f) Castings to which a quality factor exceeding 80 percent is to be applied shall be marked as required by Subpart 51.58 of this subchapter, and in addition, the applicable quality factor shall be clearly stamped on the casting.

**§ 52.05–15 Seamless pipe shells.**

(a) Shells may be seamless pipe or tubing with or without integral heads for boilers and unfired pressure vessels provided the material conforms to Subpart 51.25 or 51.34 of this subchapter, except that Grades T83, P53–A and P–53B shall not be used for boiler shells exceeding 18 inches in diameter.

**§ 52.05–20 Electric-resistance welded pipe shells.**

(a) Shells may be fabricated of electric-resistance welded pipe or tubing made of open-hearth or electric furnace steel, as specified in Subpart 51.25 or 51.34 of this subchapter, not exceeding 24 inches in diameter for boiler shells and 30 inches in diameter for unfired pressure vessel shells. The maximum allowable stress values in Table 52.05–10(a) shall be substituted in Formulas (1) or (2) of § 52.05–10 for the values of SE.

(b) Holes for tubes, nozzles, or other openings shall not be drilled in the weld.

**§ 52.05–30 Externally fired boilers.**

The thickness of shell plates of externally fired boilers shall not exceed 0.45 inch.

## Subpart 52.10—Shell Joints

**§ 52.10–1 Type of shell joints.**

The shells of boilers or unfired pressure vessels may be fabricated by riveting or welding.

**§ 52.10–5 Materials and workmanship.**

(a) The buttstraps of riveted joints shall be of steel conforming with the specifications and requirements for the shell plates.

(b) Rivets shall conform to the requirements of Part 51 of this subchapter, as follows:

| | |
|---|---|
| Steel rivets | Subpart 51.07 |
| Iron rivets | Subpart 51.13 |

(c) Rivet holes shall be drilled wholly and fairly, preferably in position. After drilling, plates and straps shall be disassembled, burrs removed, and edges of holes faired before the plates are riveted together. Drifting of rivet holes is prohibited.

(d) The calking edges of plates, buttstraps, and heads shall be beveled to an angle not sharper than 70° to the plane of the plate and as near thereto as practicable. Every portion of the unfinished surfaces of the calking edges of plates, buttstraps, and heads shall be planed or milled to a depth of not less than ¼ of the thickness of the plate, but in no case less than ⅛ inch. Calking shall be done with a tool of such form that there is no danger of scoring or damaging the plate underneath the calking edge, or splitting the calked sheet.

(e) Plates and shapes shall be so closely fitted, metal to metal, as to require a minimum of calking to obtain tightness.

(f) The seal welding of rivet heads to secure tightness is prohibited.

**§ 52.10–8 Longitudinal riveted joints.**

(a) The longitudinal joints of drums and shells of all boilers shall be of riveted double-butt strap construction, at least double-riveted.

(b) The longitudinal joints of externally fired fire-tube or flue boilers shall be located above the fire line of the setting.

(c) Boiler shell plates having longitudinal joints shall be rolled or formed by pressure, not blows, to the proper curvature.

(d) The maximum allowable pitch of rivets in longitudinal joints shall be such as to insure good calking.

(e) The distance between the center lines of any two adjacent rows of rivets in longitudinal joints or the "back pitch" measured at right angles to the direction of the joint, shall have the following minimum values:

(1) If $\frac{P}{d}$ is 4 or less, the minimum value shall be: 2d, or

(2) If $\frac{P}{d}$ is over 4, the minimum value shall be: $2d+0.1(P-4d)$

where:

$P$ = Pitch of the rivets in outer row where a rivet in the inner row is located midway between two rivets in the outer row, in inches, or

$P^1$ = pitch of rivets in the outer row less pitch of rivets in the inner row where two rivets in the inner row is located between two rivets in the outer row, in inches.

$d$ = diameter of the rivet holes, in inches.

(3) The "back pitch" of rivets shall be measured either on the flat plate before rolling or on the median line after rolling. The "back pitch" thus measured shall govern the locations of the rivet holes in the buttstraps. The diagonal ligaments between staggered rivets shall have the proper strength, as determined by figure 52.40–5 (c4).

[1] It is assumed that the joints are of the usual construction where the rivets are symmetrically spaced.

(f) On longitudinal joints the distance from the center of rivet holes to the edge of the plate, except rivet holes in the ends of buttstraps, shall be not less than 1½ and not more than 1¾ times the diameter of the rivet holes, the distance to be measured from the center of the rivet holes to the calking edge of the plate before calking.

**§ 52.10–10 Efficiency of riveted joints.**

(a) The efficiency of riveted joints is the ratio which the strength of the joint bears to the strength of the solid plate. The efficiency of a riveted joint is determined by calculating the breaking strength of a unit section of the joint, considering each possible mode of failure separately, and dividing the lowest result by the breaking strength of the solid plate of a length equal to that of the section considered. It shall be computed in accordance with the following formulas:

(1) For plate section:

$$E=\frac{P-d}{P} \quad (1)$$

(2) For rivet section:

$$E=\frac{Nas}{PST} \quad (2)$$

(3) For combined efficiency of plate in second row and shearing strength of rivet in outer row:

$$E=\frac{p-d}{p}+\frac{nas}{PST} \quad (3)$$

[1] Critical sections of a casting are defined as the sections where defects are usually encountered, such as the junction of risers, gates, or feeders to the castings, and at abrupt changes in section. All integrally cast bosses and all chaplets and internal chills shall be radiographed.

(4) For combined efficiency of plate in second row and crushing strength of buttstrap in front of rivet in outer row:

$$E=\frac{p-d}{p}+\frac{ncdt}{PST} \quad (4)$$

where:

$E$ = efficiency of riveted joint in ratio to solid plate.
$P$ = pitch in inches of rivets in outer row.
$p$ = pitch in inches of rivets in second row.
$d$ = diameter of rivet hole, in inches.
$N$ = total number of rivets per pitch $P$.
$n$ = number of rivets in outer row per pitch $P$.
$T$ = thickness of shell plate, in inches.
$t$ = thickness of buttstrap, in inches.
$a$ = sectional area of the driven rivet, in square inches.
$c$ = crushing strength of plate in front of rivets. (Assumed as 95,000 pounds per square inch.)
$S$ = tensile strength of plate in pounds per square inch.
$s$ = shearing strength of rivets in pounds per square inch of sectional area, assumed as follows:

| | |
|---|---|
| Iron rivets in single shear | 38,000 |
| Iron rivets in double shear | 76,000 |
| Steel rivets, grade A, in single shear | 44,000 |
| Steel rivets, grade A, in double shear | 88,000 |
| Steel rivets, grade B, in single shear | 52,000 |
| Steel rivets, grade B, in double shear | 104,000 |
| Alloy-steel rivets, grade C, in single shear | 60,000 |
| Alloy-steel rivets, grade C, in double shear | 120,000 |

(b) Where the drums of water-tube boilers are pierced through the longitudinal buttstrap joint for the purpose of inserting tubes to connect the headers to the drum, the combined thickness of both buttstraps shall be taken in computing the efficiency of the ligament between tube holes. This efficiency shall in no case be less than that required for the riveted joint.

### § 52.10–15 Buttstraps and computations.

(a) The thickness of buttstraps shall be such as to permit efficient calking of the edges. Where the pitch of the rivets is so great as to make effective calking doubtful, as occurs in quadruple riveting, the edge should be scalloped around the outer rivets.

(b) The thickness of the outer buttstrap shall be not less than that determined by the following formula, but it shall in no case be less than ¼ inch:

$$t=\frac{5T(P-d)}{8(P-Kd)} \quad (1)$$

where:

$t$ = thickness of outer strap, in inches.
$T$ = required thickness of shell plate, in inches.
$P$ = pitch of rivets in outer rows, in inches.
$d$ = diameter of rivet holes, in inches.
$K$ = ratio of pitch of rivets in outer row to minimum pitch in inner rows.

(c) The thickness of the inner buttstrap shall equal $t$ plus 0.125 inch, but is not required to exceed the thickness of the shell plate.

(d) The thickness of buttstraps on drums of water-tube boilers pierced for the purpose of inserting tubes to connect the headers to the drums, shall be increased if necessary to maintain the efficiency on which the allowable pressure is based.

(e) Buttstraps shall be formed to the curvature of the shell by rolling or pressing.

### § 52.10–20 Circumferential joints.

(a) The minimum strength of circumferential joints attaching shells to heads of boilers or other pressure vessels shall bear the following ratios to that required for the longitudinal joints of the shell:

(1) Fifty percent when no part of the load on the head is supported by either tubes or stays.

(2) Forty percent when one-half or more of the load on the head is sustained by stay tubes, flues, or stays; except that circumferential head joints of externally fired fire-tube or flue boilers exposed to fire or to the products of combustion, shall have a minimum strength of not less than 50 percent of that of the longitudinal joint.

(b) The strength of the circumferential joints connecting courses of the shell shall be not less than 75 percent of that required for the longitudinal joints of the shell except that in the case of externally fired flue boilers the strength of circumferential joints need not exceed 60 percent of the strength of the longitudinal joint.

(c) Circumferential end joints of shell plates over ⅝ inch thick and circumferential joints connecting courses of shells, the required thickness of which is over ½ inch, shall be at least double riveted. Where the thickness of the shell plate exceeds 1⅜ inches for single-ended boilers, and 1⅜16 inches for double-ended boilers, the circumferential seams connecting shell courses shall be triple riveted.

(d) On circumferential joints of shells having heads which are not supported by tubes or through stays, the distance from the center of rivet holes to the calking edges of the plates, shall be not less than 1½ and not more than 1¾ times the diameter of the rivet holes. The distance from the centers of rivet holes of circumferential joints to the edges of the plate in boilers having heads which are supported by tubes or through stays shall not be less than 1¼ times the diameter of the rivet holes.

(e) The distance between any two rows of rivets in a circumferential joint or the "back pitch" shall be not less than 1¾ times the diameter of the rivet hole.

### § 52.10–25 Welded joints.

(a) Drums, shells, or other cylindrical pressure parts and non-cylindrical pressure parts of boilers and unfired pressure vessels, except stays or braces as specified in Subpart 52.35, may be fabricated by means of arc or gas welding, provided the construction meets the requirements for material and design as specified in Parts 51 and 52 of this subchapter, and the welding conforms to the requirements of Part 56 of this subchapter.

(b) Arc or gas welding used in the fabrication of the pressure parts of boilers, as specified in paragraph (a) of this section, need not be radiographed, unless otherwise specified in this subchapter, provided the stress or load is carried by other construction which conforms to the requirements of the regulations in this subchapter, such as stays, staybolts, and stay tubes, and where the adequacy of the boiler design is not solely dependent upon the strength of the weld. Welding done under these provisions shall otherwise conform in all respects to Part 56 of this subchapter, unless otherwise specified in this subchapter.

(c) Arc or gas welding is permitted in the construction of boilers and unfired pressure vessels for the purpose of securing tightness in parts of riveted joints which are otherwise constructed fully in accordance with the regulations in this subchapter.

(d) The ends of inner butt-straps of riveted butt-strap longitudinal joints may be arc- or gas-welded to the edges of heads or of the adjoining shell plate, or to the circumferential butt-straps for tightness. When the butt-strap of a longitudinal joint does not extend the full length of the shell plates, the abutting edges of the shell plate may be welded provided the distance from the end of the butt-strap to the edge of the flange of the head or adjacent shell plate is not greater than 2½ inches.

(e) The longitudinal and circumferential joints of corrugated furnaces may be fabricated by arc welding in accordance with the requirements of § 52.50–15 (g).

(f) (1) A furnace in a fire-tube boiler may be attached to an outwardly flanged opening in a front tube sheet by a circumferential fillet weld, or, the furnace may be attached to either tube sheet by flaring the end which extends beyond the outside face of the head to an angle of 20 to 30 degrees, and using a circumferential fillet weld, provided:

(i) The area of the heads around the furnace is stayed by tubes or braces in accordance with the requirements of Subpart 52.35.

(ii) The joint is wholly outside the furnace.

(iii) The throat of the full fillet weld is not less than 0.7 times the thickness of the head.

(iv) Unless protected by refractory material, the furnace shall not extend beyond the outside face of the tube sheet a distance greater than the thickness of the tube sheet. Any excess shall be removed before welding.

(v) The welding conforms in all respects to Part 56 of this subchapter, except that radiographic examination is not required.

(2) A furnace may also be attached by a full penetration weld, provided the furnace extends through the full thickness of the tube sheet. The furnace shall not extend beyond the toe of the weld and the toe shall not project beyond the face of the tube sheet by more than ⅜ inch.

(g) Arc- or gas-welded construction may be used in lieu of riveted joints in

the fire boxes of internally-fired boilers provided the welds are located between two rows of staybolts, or in the case of flat surfaces, the weld is not less than one half of a staybolt pitch from the corner of the knuckle.

(h) The bottom edges of plates of vertical tubular and firebox types of boilers may be attached by full penetration butt welds provided the load due to internal pressure is carried by staybolting and the inside width of the waterleg does not exceed 4 inches. The plates may be considered as fully supported if the distance from the welds to the nearest row of staybolts is not more than one-half the pitch allowed by Subpart 52.35.

(i) Mud rings of plate material may be used in the construction of waterlegs of vertical fire-tube boilers and may be attached as shown in figure 52.22–10 (E), provided the width of the waterleg does not exceed 4 inches, and the thickness of the mud ring plate is at least ½ inch. The welding shall be stress-relieved, but radiographic examination is not required.

(j) Fire-tube boilers may be constructed by attaching an unflanged tube sheet to the shell or wrapper sheet by welding provided that:

(1) The tube sheet is supported by tubes or braces, or both, in accordance with the requirements of Subparts 52.30 and 52.35.

(2) The welded joint is wholly within the shell or wrapper sheet and forms no part thereof.

(3) The weld is a full penetration weld, of at least the full thickness of the tube sheet, applied from either or both sides.

(4) The shell or wrapper sheet, where exposed to primary furnace gases and not water cooled, does not extend more than ⅛ inch beyond the outside face of the tube sheet.

(5) The weld attaching a furnace or lower tube sheet of a vertical fire-tube boiler to the furnace sheet is wholly within the furnace sheet and ground flush with the upper or water side of the tube sheet.

(6) The welding conforms in all respects to Part 56 of this subchapter, except that radiographic examination is not required.

(7) This construction shall not be used on the rear head of a horizontal-return tubular boiler.

## Subpart 52.15—Domes and Steam Chimneys

### § 52.15–1 Definitions.

(a) *Domes.* Domes are superstructures of shells, attached by riveting or welding. They generally consist of a cylindrical shell with one end flanged for attachment to the main shell and the other end closed by a head which may be integral with, riveted, or welded to the shell.

(b) *Steam chimneys.* Steam chimneys are superstructures of steam boilers which are fitted with a lining inside of which the products of combustion pass to the smokestack. They may be constructed in the form of a dome integral with the boiler or as independent steam vessels connected by piping to the boiler.

### § 52.15–5 Materials and workmanship.

(a) Steel plates used in the construction of domes and steam chimneys shall conform to the specifications and requirements for the shell plates.

(b) Rivets shall conform to the requirements of Part 51 as follows:

| | |
|---|---|
| Steel rivets | Subpart 51.07 |
| Iron rivets | Subpart 51.13 |

### § 52.15–10 Computations.

(a) The maximum allowable pressure and the minimum thickness of the shell of domes and steam chimneys shall be computed as specified for cylindrical shells in Subpart 52.05, employing the minimum efficiency of the joint.

(b) Flat surfaces of heads of domes and steam chimneys shall be stayed as specified for surfaces to be stayed or reinforced in Subparts 52.30 and 52.35.

(c) The maximum allowable pressure on unstayed steam chimney linings, or the minimum thickness of such linings, shall depend upon their type and shall be computed in accordance with the requirements for furnaces and flues specified in Subpart 52.50.

(d) A cylindrical surface exposed to external pressure and not entirely self-supporting shall be stayed in accordance with the requirements of Subparts 52.30 and 52.35, specifically § 52.30–10 (g).

(e) The strength of the rivets and of ligaments between rivets in the flange attaching a dome or steam chimney to a main shell shall be sufficient to give a factor of safety of not less than six against the full load acting on the head. This factor of safety may be reduced to not less than four when not less than 50 percent of the load on the head is carried by stays secured to the main shell.

(f) Domes attached to shells of boilers shall comply with the requirements for reinforced openings as specified in Subpart 52.25.

### § 52.15–15 Detail requirements.

(a) All domes and steam chimneys shall be so arranged that any water can drain back into the boiler.

(b) The diameter of a dome shall not exceed one-half of the diameter of the boiler shell.

(c) Flanges of domes shall be formed with a corner radius of at least twice the thickness of the plate for plates 1 inch in thickness or less, and at least three times the thickness of the plate, for plates over 1 inch in thickness.

(d) The longitudinal joints of a dome or steam chimney may be butt-welded and the dome flange may be double full-fillet lap-welded to shell, in lieu of riveting, provided the welding fully complies with the requirements of Part 56 of this subchapter, except that radiographic examination of the fillet welds may be omitted.

## Subpart 52.20—Dished Heads

### § 52.20–1 Definitions.

(a) *Unstayed heads.* Unstayed heads are the ends of a pressure vessel shell. They may be either flat or dished. Heads may be integral with, riveted or welded, to the shell.

(b) *Dished heads.* Dished heads are heads formed to a segment of a sphere or to a hemispherical or elliptical section and may be attached to the shell so that the pressure will be either on the concave or on the convex side.

### § 52.20–5 Materials and workmanship.

(a) Steel plate used in the fabrication of dished heads shall conform to the specifications and requirements for the shell plates. Welding caps, conforming to the requirements of subpart 51.34 of this subchapter may be used as end closures in water drums and headers, provided the diameter does not exceed 24 inches. Flanged or dished heads if pressed or flanged cold shall be stress-relieved as required by § 56.01–70 of this subchapter after the cold forming operations are completed. Heads that are flanged or dished hot need not be stress-relieved.

NOTE: It is not mandatory in fresh and salt water service systems that flanged or dished heads be stress-relieved for use on compression tanks with an air cushion containing liquids operating at temperatures not exceeding 212° F.

(b) The inside radius of the bend of the flange formed on an unstayed dished head shall be not less than three times the thickness of the head and shall in no case be less than 6 percent of the outside diameter of the flanged portion of the head.

(c) Dished heads having the pressure on the convex side shall be formed to a true surface without flats.

(d) The heads here considered are of steel plate. Cast-steel, bronze and cast-iron heads may be used for unfired pressure vessels, but only where specifically authorized by the Commandant.

(e) The edge of the flange formed on a head shall be machined to a true surface. Where the flange is to be calked inside, the edge shall be beveled as specified for the edges of plates and straps in § 52.10–5. Care shall be taken in calking to avoid damaging the surface of the plate.

(f) The holes for rivets to attach the head to the shell shall, as far as practicable, be drilled in position, and the shell and head shall be taken apart after the holes are drilled, and burrs removed. In cases where holes cannot be drilled in position, the holes shall be examined after assembly and faired by reaming where necessary. (The requirements to take apart shell and head for removing burrs shall not apply to heads where the contact surfaces have been machined and the heads shrunk in place.)

### § 52.20–10 Computations.

(a) The maximum allowable pressure and the minimum thickness of blank unstayed spherically dished heads, hemispherical heads, or ellipsodial heads having the pressure on the concave side shall be calculated by the following formulas:

(1) *Spherically dished heads.*

$$P=\frac{STE}{0.833R} \quad (1)$$

$$T=\frac{0.833PR}{SE} \quad (2)$$

(2) *Hemispherical heads.*

$$P=\frac{2STE}{R} \quad (3)$$

$$T=\frac{PR}{2SE} \quad (4)$$

where:

$P$=maximum allowable pressure, in pounds per square inch.

$S$=maximum allowable stress, in pounds per square inch, taken from tables 52.05–10 (a) and 54.03–10 (c), and subject to the limitations of § 52.05–12.

$T$=minimum thickness of the head, in inches.

$E$=efficiency of the weakest joint used in forming the head, including the head to shell joint for hemispherical heads only, for the following types:

Riveted joints=calculated riveted efficiency, § 52.10–10.

Welded joints=efficiency specified in table 56.01–30 (a).

Seamless shells with integral heads=100 percent.

$R$=radius to which the head is dished or formed, measured on the concave side, in inches.

(3) *Ellipsoidal heads.* A blank head of a semi-ellipsoidal form in which half the minor axis (or the inside depth of the head not including the flange) is at least equal to one-fourth of the inside diameter of the head flange, shall be made at least as thick as the required thickness of the seamless shell of the same diameter, as specified in § 52.05–10.

(b) The radius to which a head is dished shall be not greater than the outside diameter of the flanged portion of the head. Where two radii are used, the longer shall be taken as the value of $R$ in formulas (1) and (2) of this section.

(c) The maximum allowable pressure and minimum thickness of dished cast steel or bronze heads, where permitted, shall be calculated by the appropriate formulas in this section.

(d) The maximum allowable pressure and minimum thickness of cast-iron dished heads, where permitted, shall be calculated by the appropriate formulas in Part 54 of this subchapter for unfired pressure vessels.

### § 52.20–15 Detail requirements.

(a) Where the radius $R$ to which a dished head is formed is less than 80 percent of the inside diameter of the shell, the thickness of a head with a flanged-in manhole opening shall be not less than the value found by making $R$, in Formulas (1) and (2) in § 52.20–10, equal to 80 percent of the inside diameter of the shell and with the added thickness for the manhole. The thickness calculated shall be the minimum thickness of a head with a flanged-in manhole opening for any form of head and the maximum allowable stress shall not exceed 80 percent of the values given in Table 52.05–10 (a) or 54.03–10 (c) in Part 54 of this subchapter.

(b) When dished heads are of a thickness less than called for by § 52.20–10 they shall be stayed as flat surfaces. Allowance may be made for the holding power of the spherical form provided the following conditions are met:

(1) The heads are at least two-thirds of the thickness required for unstayed dished heads;

(2) The heads are at least ⅞ inch in thickness;

(3) Through stays are used and attached to the dished head by outside and inside nuts; and,

(4) The maximum allowable pressure shall not exceed that calculated by the regulations for an unstayed dished head plus the pressure corresponding to the strength of the stays or braces obtained by Subpart 52.30, using 170 for the value of $C$.

(c) If a dished head concave to the pressure is formed with a flattened spot or surface, the diameter of the flat spot shall not exceed that allowed for flat heads as given by formulas (1) and (2) of § 52.22–10, and the minimum thickness shall be computed by these formulas, using $C$=0.25.

(d) When a spherically dished head has a flanged-in manhole or other access opening exceeding 6 inches in any dimension, the thickness of the head shall be increased by not less than 15 percent of the required thickness for a blank head computed by formula (2) of § 52.20–10, but in no case by less than ⅛ inch additional thickness over a blank head.

(e) If a flanged-in manhole which meets the requirements of § 52.20–20 is placed in a full-hemispherical head or ellipsoidal head, the thickness of the head shall be the same as for a head dished to a segment of a sphere, with the radius of dish equal to eight-tenths of the inside diameter of the shell and with the added thickness for the manhole as specified in paragraph (d) of this section.

(f) (1) Except as provided for in paragraphs (d) and (e) of this section, all openings which require reinforcement placed in an unstayed spherically dished head, or an ellipsoidal head, or in a full-hemispherical head, including all types of manholes except those of the integral flanged-in type, shall be reinforced in accordance with § 52.25–20.

(2) When so reinforced, the thickness of such a head may be the same as for a blank unstayed dished head.

(g) Where a spherically dished head has a flanged opening supported by an attached flue, an increase in the thickness over that computed by formula (2) of § 52.20–10 is not required.

(h) If more than one flanged-in manhole or access opening is inserted in a dished head, the thickness of which is calculated by paragraph (d) of this section, the minimum distance between the openings shall be not less than one-fourth of the outside diameter of the head.

(i) (1) The maximum allowable pressure and the minimum thickness of an unstayed dished head of any form excluding hemispherical heads, without manhole or handholes with the pressure on the convex side shall be calculated by Formulas (1) and (2) of § 52.20–10, but only 60 percent of the maximum allowable pressure thus determined shall be allowed.

(2) The maximum allowable pressure and minimum thickness of an unstayed hemispherical head without manhole or handholes with the pressure on the convex side shall be calculated by Formulas (3) and (4) of § 52.20–10, but only 60 percent of the maximum allowable pressure thus determined shall be allowed.

(j) No head, except a full-hemispherical head, shall be of a lesser thickness than that required for a seamless shell of the same diameter.

(k) When the flange of an unstayed dished head is machined to make a close fit into or onto the shell, the thickness shall be not reduced to less than 90 percent of that required for a blank head.

### § 52.20–20 Openings in dished heads.

(a) Flanged-in manhole openings in a dished head shall be flanged to a minimum radius measured on the inside of the plate of not less than ⅞ inch for plates up to and including 1⅛ inches in thickness, and for plates exceeding 1⅛ inches in thickness, the radius shall be increased proportionately. The minimum depth of the flange measured from the outside of the opening along the major axis shall be not less than three times the required thickness of the head, or the required thickness of the head plus three inches, whichever is less.

(b) A manhole opening may be reinforced by a riveted manhole frame or other attachment in lieu of flanging.

(c) Unreinforced openings (or openings with inherent reinforcement) in dished heads shall be governed by the following:

(1) The edge of any unreinforced opening, excluding rivet holes, shall come no closer to the line bounding the spherical or ellipsoidal portion of the head around a manhole than the distance equal to the thickness of the head, and in no case, except for water-column connections, shall it come within the part formed by the corner radius of a dished head.

(2) The maximum allowable diameter of any unreinforced opening in a head, except in a full-hemispherical head, shall not exceed that permitted by § 52.25–15 (a) for a shell of the same outside diameter as the outside diameter of the flange of the head, of the same thickness, allowable pressure and material as that in the head, nor shall it exceed 8 inches in any case.

(3) For unreinforced openings in full-hemispherical heads, the requirements of subparagraph (2) of this paragraph shall apply, except that the value of $K$ shall be one-half the value given by the formula in § 52.25–15 (a).

(4) The minimum distance between the centers of any two unreinforced

openings, rivet holes excepted, shall be determined by the following formula:

$$L=\frac{A+B}{2(1-K)} \quad (2)$$

where:

$L$ = distance between the centers of the two openings, measured on the surface of the head, in inches.

$A$ and $B$ = diameters of the two openings in inches.

$K$ = same as defined in § 52.25–15 (a) for the equivalent shell described in subparagraph (2) of this paragraph.

## Subpart 52.22—Flat Heads

### § 52.22–1 Definitions.

(a) *Unstayed heads.* Unstayed heads are the ends of a pressure vessel. They may be either flat or dished. Heads may be integral with, riveted, or welded to the shell. Unstayed flat heads may be used to close shells as permitted by § 52.22–10.

(b) *Stayed heads.* Stayed heads are heads supported in whole or in part by stays, furnaces, flues, tubes, etc.

### § 52.22–5 Materials and workmanship.

(a) Steel plate used in the fabrication of flat heads shall conform to the specifications and requirements for the shell plates, except that small end closures in headers may be made of material complying with subpart 51.22 of this subchapter.

(b) The heads here considered are of steel plate. Cast steel, cast iron or bronze heads may be used for pressure vessels other than boilers, but only where specifically authorized by the Commandant.

### § 52.22–10 Computations.

(a) The maximum allowable pressure and minimum required thickness of unstayed flat heads, cover plates, blind flanges, etc., shall be determined by the following formulas:

$$P=\frac{ST^2}{CD^2} \quad (1)$$

$$T=D\sqrt{\frac{CP}{S}} \quad (2)$$

where:

$D$ = diameter, or shortest span, measured as indicated in figure 52.22–10, in inches.

$P$ = maximum allowable pressure, in pounds per square inch.

$T$ = minimum required thickness of plate, in inches.

$S$ = maximum allowable stress, in pounds per square inch, taken from tables 52.05–10 (a) and 54.03–10 (c) and subject to the limitations of § 52.05–12.

$C$ = 0.162 for plates rigidly riveted or bolted to shells, flanges, or side plates as shown in figure 52.22–10 (A); and for integral flat heads as shown in figure 52.22–10 (B) where dimension D does not exceed 24 inches and the ratio of thickness of the head to dimension D is at least equal to or greater than 0.05.

$C$ = 0.25 for heads forged integral with or butt-welded to shells, pipes, or headers as shown in figures 52.22–10 (C) and (D), where the corner radius on the inside is not less than three times the thickness of the flange immediately adjacent thereto, and where the welding meets all the requirements for circumferential joints given in Part 56, including stress relieving and radiographic examination.

$C$ = 0.50 for plates arc- or gas-welded to the inside of pressure vessels, pipes or headers and otherwise meeting the requirements for respective type of arc- or gas-welded vessels, including stress relieving but omitting radiographic examination. The plate shall be welded as shown in figure 52.22-10 (E), with a weld having a depth equal to two times the required thickness of a seamless shell, but not greater than the head thickness nor in any case less than 1.25 times the actual shell thickness, and where the weld is deposited in a welding groove with the root of the weld at the inner face of the head. The remainder of the head plate may be beveled to an angle not exceeding 45°.

$C=0.30+1.40\frac{Wh_g}{HD}$ for plates bolted to shells, flanges, or side plates, in such a manner that the setting of the bolts tends to dish the plate, and where the pressure is on the same side of the plate as the bolting flange, as shown in figures 52.22–10 (F) and (G), where:

$W$ = flange design bolt load, in pounds.

$h_g$ = radial distance from the bolt-circle diameter to the diameter $D$, in inches.

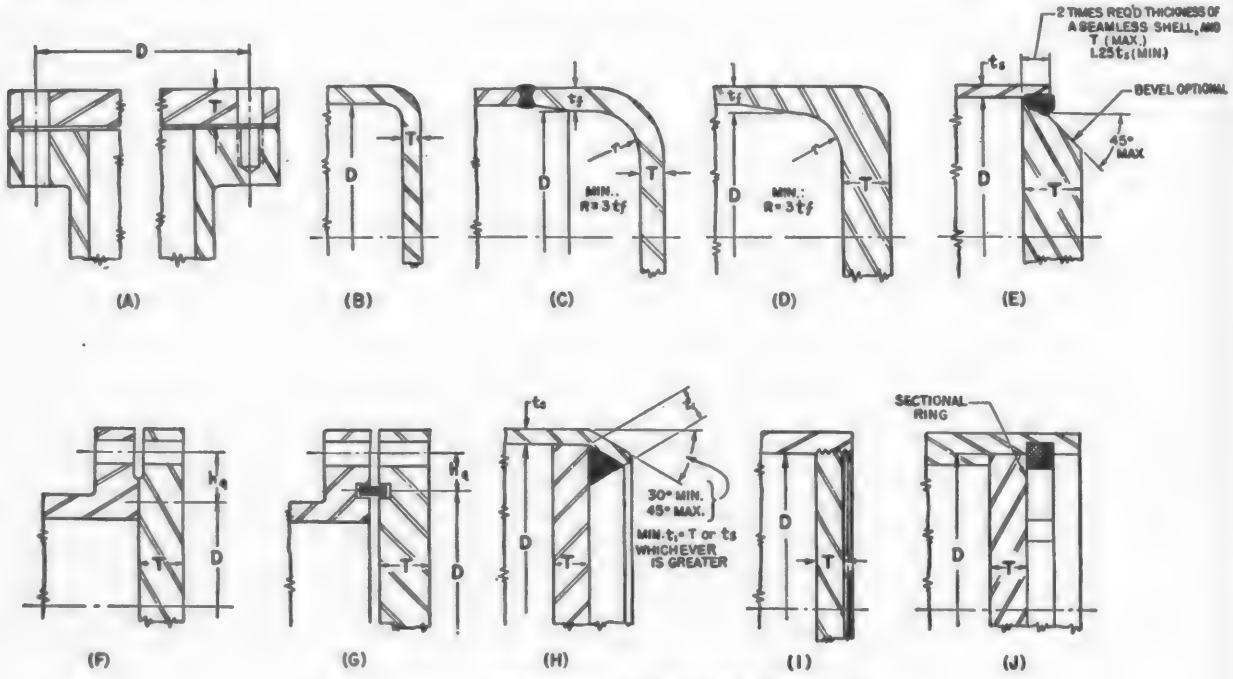



FIGURE 52.22–10—Acceptable types of flat heads.

$H$ = total hydrostatic end force on area bounded by the mean diameter of the gasket or joint contact surface, in pounds.

$D$ = diameter, or shortest span, measured as indicated in figure 52.22–10, in inches.

$C$ = 0.50 for plates having a dimension $D$ not exceeding 18 inches inserted into pressure vessels and welded thereto as shown in figure 52.22–10 (H), and otherwise meeting the requirements for the respective type of class II welded pressure vessel including stress relieving but omitting radiographic examination. The end of the pressure vessel shall be crimped over to an angle not less than 30° nor more than 45°. The throat of the weld shall be not less than the thickness of the shell or head, whichever is the greater.

$C$ = 0.75 for plates screwed into the end of a pressure vessel having an inside diameter $D$ not exceeding 12 inches, as shown on figure 52.22–10 (I), or for heads having an integral flange screwed over the end of a pressure vessel having an inside diameter $D$ not exceeding 12 inches. The design of the threaded joint against failure by shear, tension, or compression resulting from the end force due to pressure shall be based on a factor of safety of at least 4 and the threaded parts are at least as strong as the threads for standard piping of the same diameter, and the head shall be welded to the pressure vessel by means of a seal weld.

$C$ = 0.30 for plates inserted into the ends of pressure vessels and held in place as shown in figure 52.22–10 (J) where all possible means of failure, either by shear, tension, or compression, due to the hydrostatic end force, are resisted with a factor of safety of 4. Seal welding may be used, if desired.

### § 52.22–15 Openings in flat heads.

The reinforcement of openings in flat heads shall comply with the requirements of § 52.25–25.

## Subpart 52.24—Access and Inspection Openings

### § 52.24–1 Definitions.

(a) *Openings.* Access or inspection openings, as defined in this subpart, are holes cut in the shells or heads of boilers or other pressure vessels for the purpose of inspection and cleaning.

NOTE: Openings in the shells or heads of boilers or other pressure vessels, including domes and steam chimneys, for other purposes than above defined (such as pipe connections and mountings) are covered in Subpart 52.25.

(b) *Manhole.* A manhole is an access opening in a boiler or unfired pressure vessel of sufficient size to permit an inspector to enter the vessel. Manholes may be of elliptical or circular shape.

(c) *Handhole.* A handhole is an opening in a pressure part of a boiler or unfired pressure vessel for the purpose of access or inspection, usually not exceeding 6 inches in longest dimension. The shapes of handholes may be circular, elliptical, or rectangular with rounded corners.

### § 52.24–5 Materials and workmanship.

(a) The cover plates for manholes shall be of rolled or forged steel conforming to the requirements of Subpart 51.04 or 51.46 of this subchapter. Handhole covers may be made of rolled, forged or cast steel conforming to the requirements of Subpart 51.04, 51.22, 51.46 or 51.58 of this subchapter.

(b) Manhole covers shall be marked with the manufacturer's name or trademark together with the maximum allowable pressure.

(c) Manhole and handhole yokes or dogs shall be of forged steel, pressed steel, or cast steel conforming to the requirements of Subpart 51.04, 51.22, 51.46 or 51.58 of this subchapter. The material of bolts securing yokes or dogs and cover plates shall conform to the requirements of Subpart 51.07 of this subchapter.

(d) When handhole or other access openings are made, a margin of not less than ¼ inch shall be left when punching operations are used, and not less than ⅛ inch shall be left when machine burning methods are employed. Such margins shall be machined or ground away to relieve the metal of any stresses which may be set up due to burning or punching operations.

(e) The minimum width of bearing surface for a gasket on a manhole opening shall be $1\frac{1}{16}$ inch. No gasket for use on a manhole or handhole of any boiler shall have a thickness greater than ¼ inch, when compressed.

### § 52.24–10 Detail requirements.

(a) All boilers or pressure parts thereof shall be provided with suitable manhole, handhole, or other inspection openings for examination and cleaning.

(b) Manhole openings shall be of elliptical form, the dimensions of which shall be not less than 10 by 16 inches or 11 by 15 inches. The size 12 by 16 inches should be used wherever practicable. Circular manholes having diameters of not less than 15 inches may be permitted.

(c) A handhole opening in a boiler shell or header shall be not less than 4 inches in any direction. This requirement does not apply to small access openings such as used in superheater headers.

(d) Inspection openings smaller than specified for handholes are permissible where a handhole is impracticable.

(e) Where elliptical openings are made in the shell of a boiler or other pressure vessel, the minor axis shall, as far as practicable, be placed longitudinally.

(f) All manholes, handholes, and inspection openings shall be closed by readily removable internal cover plates which shall be held by one or more girders or dogs and bolts. The cover plates shall be formed with a projection to fit within the opening with a radial clearance not exceeding $\frac{1}{16}$ inch at any point. This projection may be in form of a raised face which shall protrude straight out from the joint face within the opening not less than ½ inch on manholes or ⅜ inch on smaller cover plates.

(g) When a threaded opening is to be used for inspection or washout purposes, it shall be not less than 1 inch pipe size. The closing plug or cap shall be of nonferrous material, except for pressures over 250 p. s. i. or temperatures over 406° F.

(h) A manhole shall be located in the front head below the tubes of a horizontal-return tubular boiler 48 inches or over in diameter. Smaller boilers shall have either a manhole or a handhole below the tubes. There shall be a manhole in the upper part of the shell or head of a fire-tube boiler over 40 inches in diameter, except on a vertical fire-tube boiler, or except on internally fired boilers not over 48 inches in diameter. Smaller boilers shall have either a manhole or a handhole above the tubes.

(i) [Reserved]

(j) A vertical fire-tube boiler shall have not less than four handhole openings in the shell located as follows:

(1) One at or about the waterline or opposite the fusible plug.

(2) Three at or about the line of the crown sheet or lower tube sheet, and if internally fired, not less than three additional handholes at the lower part of the waterleg.

(k) If a vertical fire-tube boiler is equipped with manholes or other access openings through which adequate inspection may be made, the required handholes and/or inspection openings at the waterline and for the tube sheets may be omitted.

(l) All manholes, handholes, inspection and washout openings in a shell or head shall be designed in conformance with the requirements of Subpart 52.25 of this subchapter.

## Subpart 52.25—Openings and Reinforcements [1]

### § 52.25–1 Scope.

(a) The regulations in this subpart apply to all openings in shells, headers or heads except as otherwise provided in paragraphs (b) and (c) of this section.

(b) Openings in a definite pattern, such as tube holes, may be designed in accordance with the requirements for ligaments in Subpart 52.40, provided the diameter of the largest hole in the group does not exceed that permitted by § 52.25–15.

(c) Calculations demonstrating compliance with the requirements of this subpart shall be made for all openings except:

(1) For single openings not greater than 2-inch pipe size in shells or headers

[1] The regulations governing openings as given in this subpart are based on the stress intensification created by the existence of a hole in an otherwise symmetrical section. The requirements are based on experience with vessels designed with safety factors of 4 and 5 applied to the ultimate strength of the shell material. External loadings such as those due to the movement of the ship, thermal expansion, or unsupported weight of connecting piping have not been evaluated and should be given consideration in unusual designs or under conditions of cyclic loading.

having an inside diameter not less than four times the diameter of the opening; and

(2) For tube holes arranged in a definite pattern as provided in paragraph (b) of this section.

(d) The requirements for reinforcement of openings are intended to apply to openings not exceeding the following dimensions: [2]

(1) For shells 60 inches in outside diameter or less, one-half the shell diameter but not over 20 inches.

(2) For shells over 60 inches in outside diameter, one-third the shell diameter, but not over 40 inches.

(e) Openings, as defined in this subpart, are holes cut in shells or heads of boilers or pressure vessels, including domes and steam chimneys, for the purpose of inspection and cleaning, and for the purpose of connecting nozzles or mountings to shells or heads of such boilers or pressure vessels.

(f) Manhole or other openings in a flat, stayed surface shall be deemed to be sufficiently reinforced if the plate is flanged inwards to a depth not less than that determined by § 52.20–20(a).

**§ 52.25–5 Materials and workmanship.**

(a) The material for reinforcing plates around openings shall conform to the requirements of the plate to be reinforced, except as otherwise provided in § 52.25–35. When they are locally heated for flanging or forming, they shall be properly annealed.

(b) A forged nozzle or forged flange, riveted or welded to the plate, may be considered as reinforcement, provided such fittings are properly designed to compensate for the material removed.

(c) Rivets used in securing reinforcing plates to the shell or other structural part shall conform to the requirements of Subpart 51.07 or 51.13 of Part 51 of this chapter.

(d) The inner radius of the bend of any flanged opening in heads, except manholes or other access openings as specified in § 52.20–20, shall be: for furnace attachments, not less than twice the thickness of the plate flanged; for flue attachments in externally fired boilers, not less than one and one-half times the thickness of the plate flanged.

(e) The riveted joint of a reinforcing plate fitted to an opening in the shell or other part of a boiler or other pressure vessel, shall be properly calked along the edge of the opening and the outer edge of the reinforcing plate as specified in Subpart 52.10 for riveted joints.

**§ 52.25–10 Unreinforced openings.**

Plain unreinforced openings in a definite pattern such as tube holes or openings with integral reinforcement shall not exceed the diameter determined by § 52.25–15, nor shall they exceed a diameter of 8 inches in any case.

**§ 52.25–15 Computations.**

(a)(1) The maximum diameter of an unreinforced opening as defined in § 52.25–10 shall be determined by the following formulas:

$$d = 2.75\sqrt{DT(1-K)} \quad (1)$$

$$K = \frac{PD}{1.82ST} \quad (2)$$

$$K = \frac{PD}{1.6ST} \quad (3)$$

where:

$d$ = maximum allowable diameter of unreinforced openings, in inches.
$T$ = actual full thickness of shell plate, in inches (including the 0.10 inch additional thickness).
$D$ = outside diameter of the drum or shell, in inches.
$S$ = maximum allowable stress as given in table 52.05–10 (a) or 54.03–10 (c) in pounds per square inch.
$K$ = ratio of the computed stress in the solid plate to the maximum allowable stress.
$P$ = maximum allowable pressure, in pounds per square inch.

(2) In determining the maximum size of an unreinforced opening in a shell, head, or header designed under the provisions of § 52.05–12(a), the value of $K$ shall be computed by formula (2).

(3) In determining the maximum size of an unreinforced opening in a shell, or header designed under the provisions of § 52.05–12(c) in which the value of $S$ is taken as not more than 80 percent of that given in Tables 52.05–10(a) and 54.03–10(c) in Part 54 of this subchapter, the value of $K$ shall be computed by formula (3).

(b) The maximum diameter of unreinforced openings may be determined by use of diagrams, Figures 52.25–15 (b1) and 52.25–15 (b2).

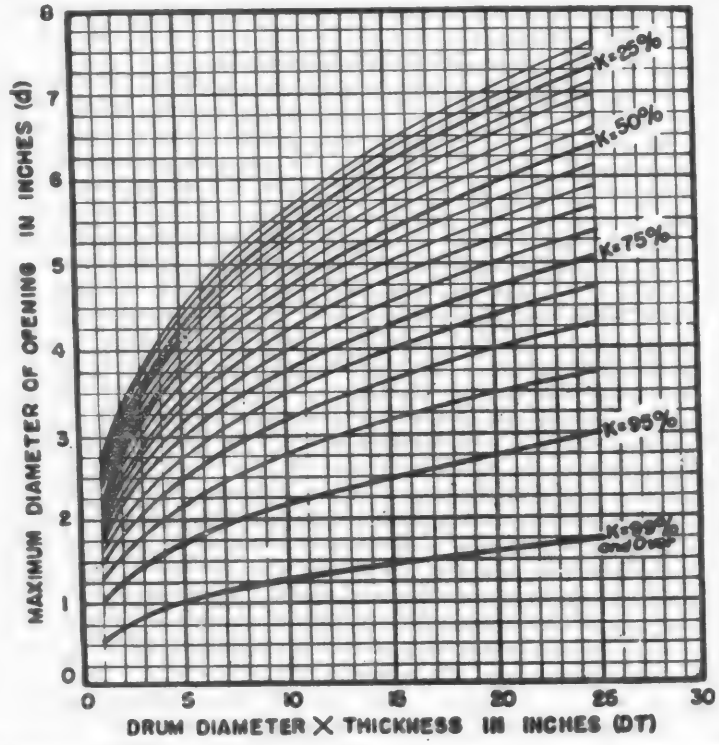



FIGURE 52.25–15 (b1)—Maximum diameter of openings with inherent reinforcement in cylindrical shells.

[2] For larger openings it is recommended that the reinforcement to be provided be distributed close to the opening and be at least equal to two-thirds of the required reinforcement within a distance of ¼ $d$ on each side of the finished opening.

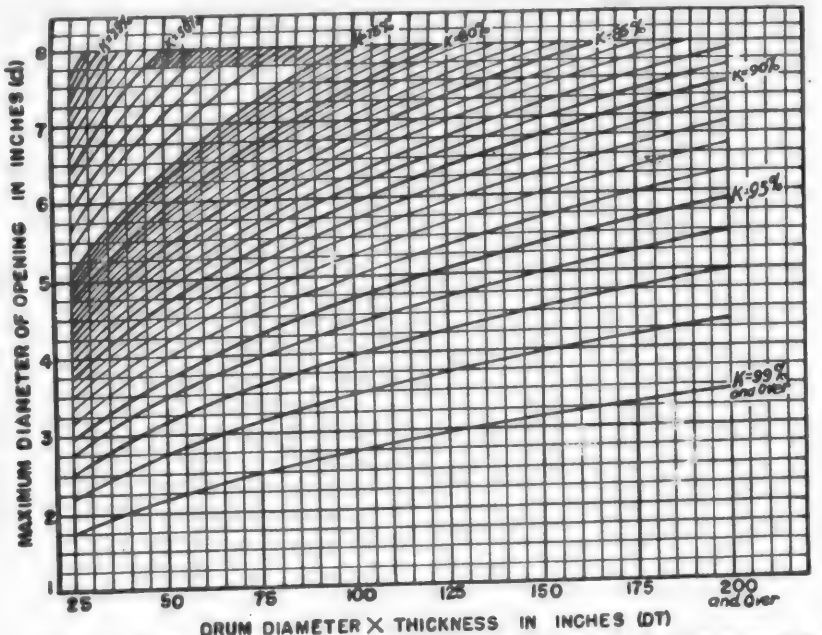



FIGURE 52.25-15 (b2)—Maximum diameter of openings with inherent reinforcement in cylindrical shells.

### § 52.25-20 Reinforced opening in shells and dished heads.

(a) The regulations in this section shall apply to all openings other than flanged-in openings in dished heads covered by § 52.20-15, openings in flat heads covered by § 52.25-25, and openings covered by § 52.25-1 (b) and (c).

(b) Reinforcement shall be provided in amount and distribution such that the area requirements for reinforcement are satisfied for all planes through the center of the opening and normal to the vessel surface. For a circular opening in a cylindrical shell, the plane containing the axis of the shell is the plane of greatest loading due to pressure.

(c) The total cross-sectional area of reinforcement in any given plane shall be not less than that prescribed by the following formula:

$$A = d \times T_r \times F \qquad (1)$$

where:

$A$ = the required area of reinforcement, in square inches.

$d$ = the diameter in the given plane of the finished opening, in inches.

$T_r$ = the required thickness of a seamless shell, header or blank head, in inches, except that: (1) For spherically dished heads when the opening and its reinforcement are entirely within the spherical portion, $T_r$ is the thickness required for a seamless hemispherical head of the same radius as that of the spherical portion; (2) for ellipsoidal heads when the opening and its reinforcement are located entirely within a circle the center of which coincides with the center of the head and diameter of which is equal to 80 percent of the shell inside diameter, $T_r$ is the thickness required for a seamless hemispherical head of radius equal to 90 percent of the inside diameter of the shell.

$F$ = 1.00 when the plane under consideration is on the longitudinal axis of a shell and for heads. For other planes in a shell or header the value of $F$ shall be determined from figure 52.25-20(c).

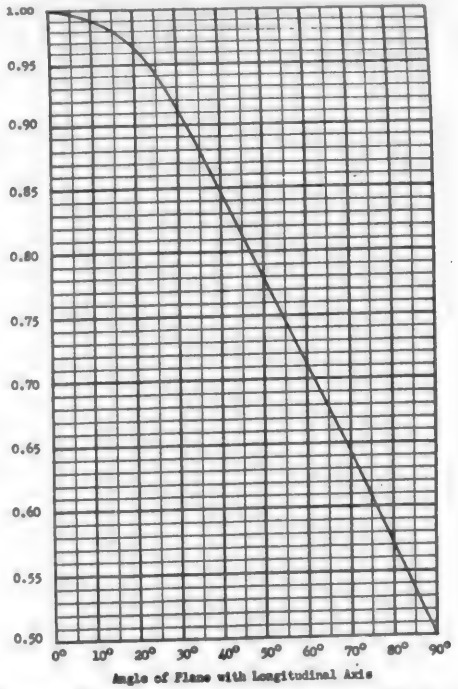



FIGURE 52.25-20 (c)—Chart for determining values of $F$.

### § 52.25-25 Reinforced openings in flat heads.

(a) Flat heads that have an opening with a diameter that does not exceed one-half of the head diameter or shortest span, as defined in § 52.22-10, shall have a total cross-sectional area of reinforcement not less than that given by Formula (1).

$$A = 0.5d \times T \qquad (1)$$

where:

$A$ = the required area of reinforcement, in square inches.

$d$ = diameter in the given plane of the finished opening, in inches.

$T$ = minimum required thickness of plate, in inches, as determined from § 52.22-10.

(b) As an alternate to paragraph (a) of this section, the thickness of flat heads may be increased to provide the necessary reinforcement by using 2C in the place of $C$ in the formulas for calculating head thickness in § 52.22-10. The value of $2C$ to be used in the formula need not exceed 0.75, except for the types of flat heads indicated by figures 52.22-10 (F) and (G).

(c) Flat heads that have an opening with a diameter that exceeds one-half of the head diameter, or shortest span, as defined in § 52.22-10, shall be designed as a flange.

### § 52.25-30 Reinforcement limits.

(a) The boundaries of the cross-sectional area in any plane normal to the vessel wall and passing through the center of the opening within which metal must be located in order to have value as reinforcement are designated as the limits of reinforcement for that plane.

(b) The limits of reinforcement, measured along the vessel wall, shall be

at a distance on each side of the axis of the opening equal to the greater of the following:

(1) The diameter of the finished opening.

(2) The radius of the finished opening plus the thickness of the vessel wall, plus the thickness of the nozzle wall.

(c) The limits of reinforcement, measured normal to the vessel wall, shall conform to the contour of the surface at a distance from each surface equal to the smaller of the following:

(1) Two and one-half times the shell thickness.

(2) Two and one-half times the nozzle wall thickness, plus the thickness of any added reinforcement exclusive of the weld metal on the side of the shell under consideration.

(d) (1) The metal thickness in the shell and nozzle wall in excess of the thickness required to resist pressure may be considered as reinforcement within the reinforcement limits given in this section.

(2) The area in the shell available as reinforcement shall be the larger of the values as given in the following formulas:

$$A_1 = (ET - FT_r)d \quad (1)$$

or,

$$A_1 = 2(ET - FT_r)(T + T_n) \quad (2)$$

where:

$A_1$ = area in the excess thickness in shell or head available for reinforcement, in square inches.

$E$ = 1, when the opening is in the solid plate or when the opening passes through a circumferential joint in a shell (exclusive of head-to-shell joints); or the longitudinal joint efficiency when any part of the opening passes through any other welded joint.

$T$ = Actual thickness of the shell or head, in inches.

$T_r$ = Required thickness of the shell or head to resist pressure, as defined in § 52.25–20, in inches.

$T_n$ = Actual thickness of the nozzle wall, in inches.

$d$ = diameter in the plane under consideration of the finished opening, in inches.

$F$ = factor from figure 52.25–20 (c).

(3) The metal thickness of the nozzle used for determining the area in the nozzle available as reinforcement shall be the difference between the actual thickness and the required minimum thickness to resist pressure. In this connection the required thickness of the nozzle may be determined by the same formula used in calculating the required thickness of the shell omitting, only in the case of boilers, the 0.1 inch additive thickness.

(4) Metal added as reinforcement and metal in attachment welds may be considered as reinforcement within the reinforcement limits.

(e) Figure 52.25–30 (e) illustrates limits of reinforcement for some typical openings.

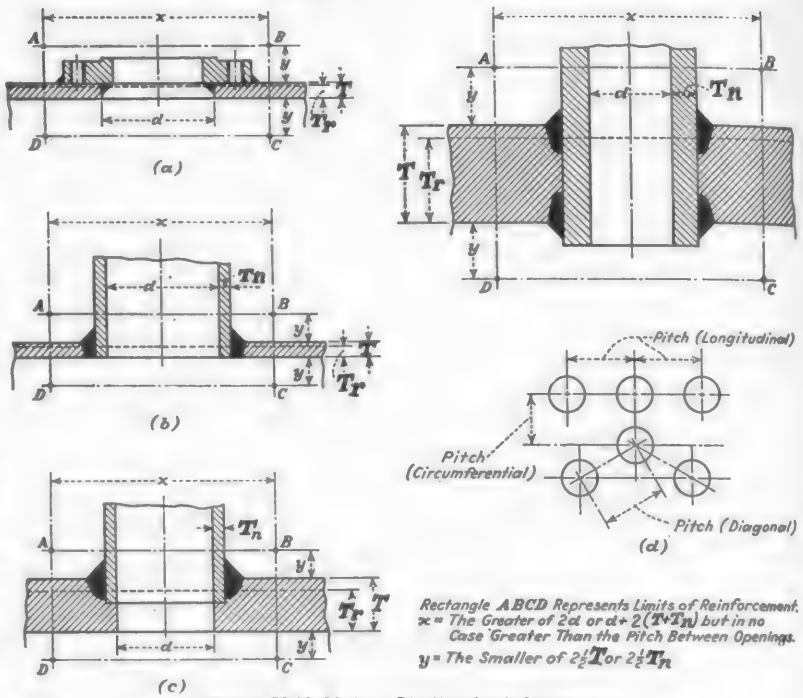



FIGURE 52.25–30 (e)—Limits of reinforcement.

§ 52.25–35 Strength of reinforcement.

(a) Material used for reinforcement shall have an allowable stress value equal to or greater than that of the material in the vessel wall, except that material of lower strength may be used provided the area of reinforcement is increased to compensate for the lower allowable stress value of the reinforcement. No credit may be taken for the additional strength of any reinforcement having a higher allowable stress value than that of the vessel wall. Where pressure vessels are designed under the provisions of § 52.05–12 (c), the allowable stress value shall be taken as equivalent to 0.8 times the values shown in tables 52.05–10 (a) and 54.03–10 (c) in Part 54 of this subchapter.

(b) On each side of the plane defined in § 52.25–30(a), the strength of the attachment joining the vessel wall and reinforcement or any two parts of the attached reinforcement, shall be at least equal to the smaller of:

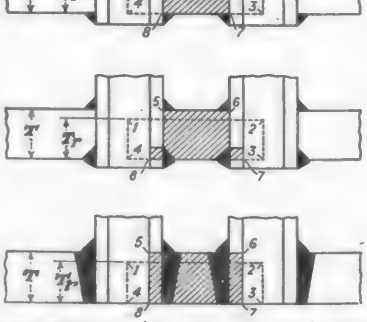
(1) The strength in tension of the cross section of the element of reinforcement being considered, or

(2) The strength in tension of the area of the unfinished opening, including any rivet or stud hole, in the shell or head based on $T_r$ less the strength in tension of the reinforcing area which is integral in the vessel wall as permitted by § 52.25–30(d). The strength of the attachment shall be considered for its entire length on each side of the plane normal to the vessel wall.

§ 52.25–40 Reinforcement of multiple openings.

(a) Two adjacent openings shall have a distance between centers not less than 1⅓ times their average diameter.

(b) When any two or larger groups of adjacent openings which require




The Cross-Sectional Area Represented by 5, 6, 7, 8 Shall be at Least Equal to the Area of the Rectangle Represented by 1, 2, 3, 4 Multiplied by 0.7F, in which F is a value from fig. 52.25-20-(c) and $T_r$ is the Required Thickness of a Seamless Shell.

FIGURE 52.25–40 (c)—Reinforcement of multiple openings.

reinforcement are so spaced that their limits of reinforcement overlap, the two or larger group of openings shall be reinforced in accordance with § 52.25–20 with a reinforcement that has an area equal to the combined area of the reinforcement required for the separate openings. No portion of the cross section shall be considered as applying to more than one opening or be evaluated more than once in a combined area.

(c) When a shell, drum or header has a series of holes in a definite pattern, the net cross-sectional area between any two finished openings within the limits of the actual shell wall, excluding the portion of reinforcing part not fused to the shell wall, shall equal at least 0.7 $F$ of the cross-sectional area obtained by multiplying the center-to-center distance of the openings by the required thickness of a seamless shell, where the factor $F$ is taken from figure 52.25–20 (c) for the plane under consideration. A typical illustration of the requirements prescribed in this paragraph is given in figure 52.25–40 (c).

### § 52.25–45 Welded connections.

(a) Sufficient welding shall be provided on either side of the plane through the center of the opening parallel to the longitudinal axis of the shell to develop the strength of the reinforcing parts through shear or tension in the weld, whichever is applicable. The strength of the groove welds shall be based on the area subjected to shear or to tension. The strength of fillet welds shall be based on the area subjected to shear (computed on the minimum leg dimension). The inside diameter of a fillet weld shall be used in figuring its length.

(b) The allowable stress values for groove and fillet welds and for shear in nozzle necks, in percentages of stress value for the vessel material, shall be in accordance with table 52.25–45(b).

TABLE 52.25–45 (b)—ALLOWABLE STRESS VALUES

| | Stress-relieved | Not stress-relieved |
|---|---|---|
| | *Percent* | *Percent* |
| Nozzle-wall shear | 70 | 70 |
| Groove-weld tension | 74 | 70 |
| Groove-weld shear | 60 | 56 |
| Fillet-weld shear | 49 | 46 |

(c) Reinforcing plates or saddles of nozzles attached to the outside of the vessel shall be provided with at least one telltale hole of ¼ inch maximum pipe tap size for testing tightness of welds that seal off the inside of the vessel. The telltale holes shall be left open when the vessel is in service.

(d) (1) The location and minimum size of attachment welds shall conform to the requirements shown in figure 52.25–45 (d), which illustrates some types of acceptable arc-welded connections.

(2) The symbols used in figure 52.25–45 (d) are defined as follows:

$t$ = thickness of vessel shell or head, less corrosion allowance, in inches.

$t_n$ = thickness of nozzle wall, less corrosion allowance, in inches.

$t_e$ = thickness of reinforcing element, in inches.

$t_w$ = dimension of partial-penetration attachment welds (fillet, single-bevel, or single-J) in inches.

$t_s$ = the smaller of ¼ inch or 0.7 $t_n$. (Inside corner welds may be further limited by a lesser length of projection of the nozzle wall beyond the inside face of the vessel wall) in inches.

$t_{min}$ = the smaller of ¾ inch or the thickness of either of the parts joined by a fillet, single-bevel or single-J weld, in inches.

(3) When nozzles or couplings are attached to boilers and unfired pressure vessels as shown in figure 52.25–45 (d), (a) and (c), and are welded from one side only, backing strips shall be used unless the inside of the joint can be visually inspected in order that the inspector may satisfy himself that complete penetration is obtained. When attachments as shown in figure 52.25–45 (d), (y) and (z), are employed they shall be limited to 2-inch pipe size for pressures exceeding 150 pounds per square inch.

(e) When the end faces of nozzles or manhole necks are to remain unwelded

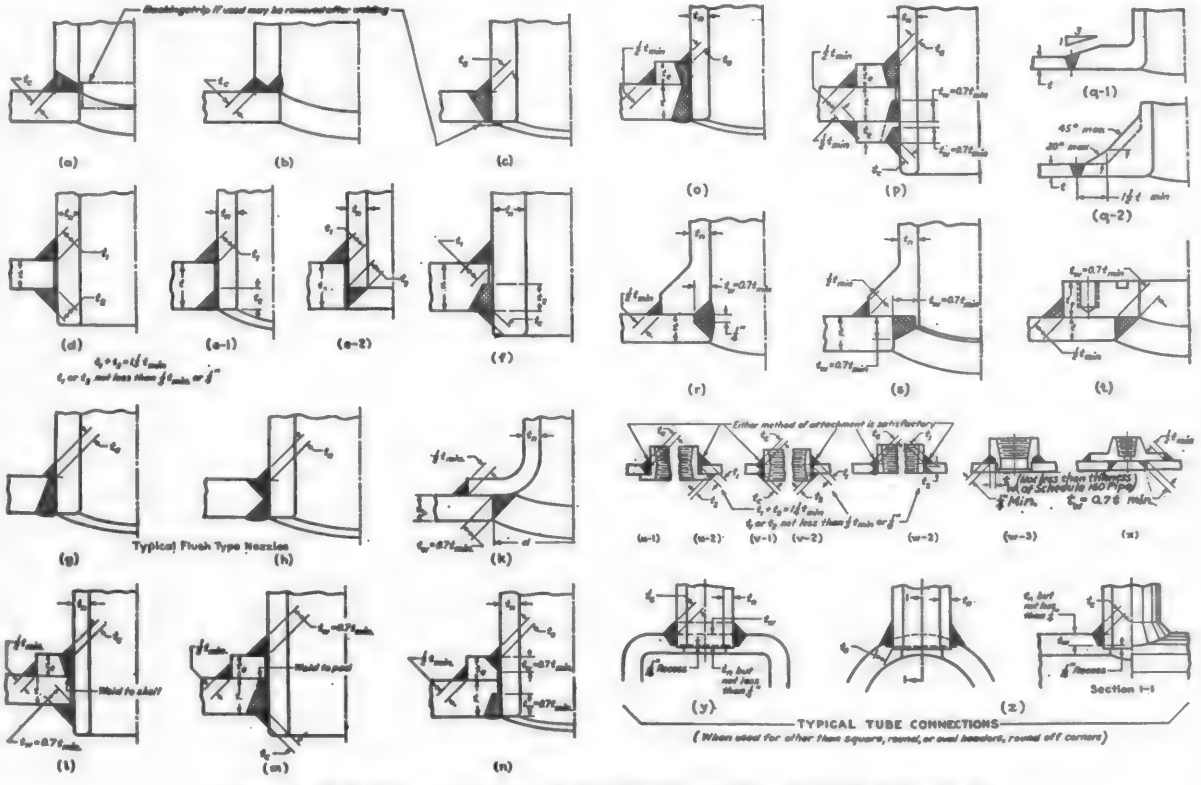



FIGURE 52.25–45 (d)—Acceptable types of welded connections to drums and headers.

in the completed vessel, these end faces shall not be cut by shearing unless at least ⅛ inch of the additional metal is removed by any method that will produce a smooth finish.

**§ 52.25–50 Riveted connections.**

(a) Openings for nozzles and other connections shall be far enough away from any main riveted joint so that the joint and the opening reinforcement plates do not interfere with one another.

(b) Welded connections which require stress-relieving and which are attached to vessels having seams of riveted construction shall be fabricated and stress-relieved prior to the making up or attachment of the courses by riveting. If they do not require stress-relieving and are attached after riveting, the welds shall be located at a distance from the riveted seam at least equal to the outside diameter of the attachment weld plus four times the thickness of the shell plate.

(c) For nozzle fittings having a bolting flange and an integral flange for riveting, the thickness of the flange attached to the pressure vessel shall not be less than the thickness of the neck of the fitting.

(d) The strength of rivets in tension in a flanged frame or ring riveted to the outside of a vessel shall be at least equal to that required to resist the load due to the maximum allowable working pressure with a factor of safety of 5 computed as follows:

(1) For outside calking the load shall be equal to the area bounded by the outside calking multiplied by the maximum allowable working pressure;

(2) For inside calking (and with no outside calking) the load shall be equal to the area bounded by the inside calking multiplied by the maximum allowable working pressure.

(e) The rivets attaching nozzles shall be so spaced as to avoid the possibility of the shell plate or the nozzle flange failing by tearing around through the rivet holes.

**§ 52.25–55 Boiler nozzle neck thickness.**

(a) The thickness of a boiler nozzle shall be not less than the thickness required for Schedule 80 pipe of the same diameter and in no case less than that determined by § 55.07–5 of this subchapter.

(b) The minimum thickness of a tube nipple when used in a reinforced opening on a boiler shall not be less than the required thickness of a boiler tube as determined by § 52.55–10 of this subchapter, but in no case less than the required minimum thickness of a tube nipple based on 600 p. s. i. internal pressure.

## Subpart 52.30—Surfaces Required To Be Stayed or Reinforced

**§ 52.30–1 Definitions.**

Surfaces to be stayed or reinforced include the following:

(a) Flat plates, heads or areas thereof, such as segments of heads, wrapper sheets, furnace plates, side sheets, combustion chamber tops, etc., which are not self-supporting.

(b) Curved plates constituting the whole or parts of a cylinder subject to external pressure which are not entirely self-supporting.

CROSS REFERENCES: For unstayed flat heads, see Subpart 52.22. For flat tube sheets, see Subpart 52.45. For curved tube sheets, see Subpart 52.40.

**§ 52.30–5 Areas to be stayed.**

The area of a segment or other portion of a flanged head to be stayed shall be that enclosed by lines as follows:

(a) Where only plain tubes are used in the bounding rows, the line of area shall be at one-half the diameter of the tube in inches, plus 2 inches from the center of the row of tubes.

(b) Where stay tubes are used in the bounding rows, the line of area shall be at one-half the maximum allowable pitch of the stays required for the plate, measured from the center of the row to stay tubes.

(c) On the side of the segments bounded by the shell or furnaces, the lines of area shall be at a distance $d$ from the shell, as shown by figure 52.30–5 (c) the distance $d$ to be computed by the following formula:

$$d=\frac{5T}{\sqrt{P}} \qquad (1)$$

where:

$d$=distance from shell, furnaces or flues considered self-supporting, in inches.
$T$=Thickness of plate, in sixteenths of an inch.
$P$=maximum allowable pressure, in pounds per square inch.

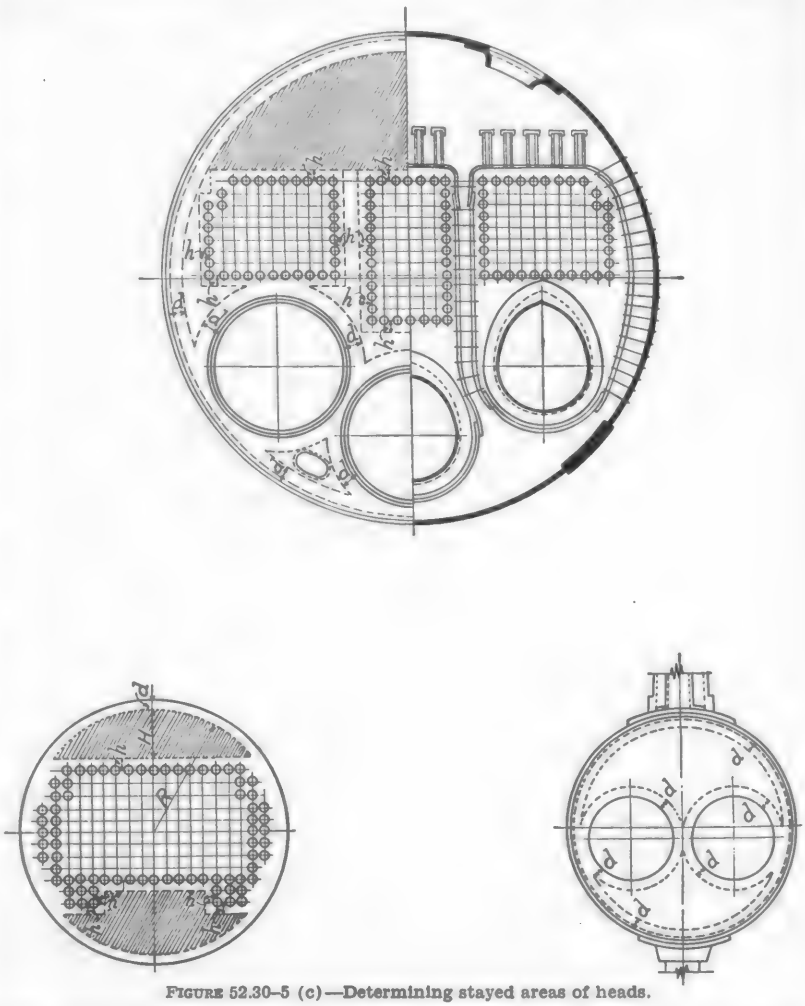


FIGURE 52.30–5 (c)—Determining stayed areas of heads.

(d) The value of $h$, as shown in figure 52.30–5 (c), shall be equal to one-half the diameter of the tube plus 2 inches where only plain tubes are used in the bounding row, or shall be equal to one-half the maximum allowable pitch of the stays required for the plate where stay tubes are used.

(e) Where the exact area of a circular segment of a flanged head cannot be readily ascertained by other accepted methods, the following formula may be

employed, using symbols indicated in Figure 52.30–5(c).

$$A=\frac{4H^2}{3}\sqrt{\frac{2R}{H}-0.6} \quad (2)$$

where:

$A$ = area of segment which requires support, in square inches.
$H$ = height of segment to self-supporting line, in inches.
$R$ = radius of segment to self-supporting line, in inches.

(f) The area of a segment of an unflanged head to be stayed shall be the area enclosed by the shell and a line drawn 2 inches from the outside diameter of the tubes.

**§ 52.30–10 Computations.**

(a) The maximum allowable pressure and minimum thickness of plates supported by stays shall be determined by the following formulas:

(1) Surfaces without doubling plates:

$$P=\frac{CT^2}{p_1^2+p_2^2} \quad (1)$$

$$T=\sqrt{\frac{P(p_1^2+p_2^2)}{C}} \quad (2)$$

(2) Surfaces fitted with doubling plates:

$$P=\frac{C_1T_1^2}{p_1^2+p_2^2} \quad (3)$$

$$T_1=\sqrt{\frac{P(p_1^2+p_2^2)}{C_1}} \quad (4)$$

(3) Where doubling plates are used, the minimum allowable thickness shall be not less than 0.67 of the thickness of the plate reinforced and the maximum thickness shall not exceed 0.75 of the thickness of the plate reinforced.

(4) The maximum allowable pitch for stays in either direction shall be computed by the following formulas:

(i) Where stays are equally spaced in both directions:

$$p_1 \text{ or } p_2=\sqrt{\frac{CT^2}{2P}} \quad (5)$$

(ii) Where the pitch in one direction is greater than that in the other direction:

$$p_1=2\sqrt{\frac{CT^2}{5P}} \quad (6)$$

(iii) With the greater pitch thus determined for one direction, the maximum pitch in the other direction shall be computed by the formula:

$$p_2=\sqrt{\frac{CT^2}{P}-p_1^2} \quad (7)$$

(5) In no case shall $p_2$ be less than one-half $p_1$.

where:

$P$ = maximum allowable pressure, in pounds per square inch.
$T$ = thickness of plate, in sixteenths of an inch.
$T_1$ = combined thickness of plate and doubler or washer, in sixteenths of an inch.
$p_1$ = pitch of stays in one direction, in inches.
$p_2$ = pitch of stays in the other direction, in inches.
$C$ and $C_1$ = coefficients based upon a minimum tensile strength of the plate, not less than 55,000 pounds per square inch, the kind of service to which subjected, and the method of construction, as follows:

Plates exposed to products of combustion:
$C$ = 238 for plates under 7/16 inch in thickness, fitted with screw stays with nuts or welded collars, or stays attached to plates by welding.
$C$ = 170 for plates 7/16 inch and over in thickness, fitted with screw stays with riveted heads.
$C$ = 250 for plates 7/16 inch and over in thickness, fitted with screw stays with nuts or welded collars, or stays attached to plates by welding.
$C$ = 190 for all plates fitted with stays secured by rivets.
$C$ = 275 for plates fitted with stay tubes screwed and expanded in nests of tubes.
$C$ = 320 for plates fitted with stay tubes screwed, expanded, and beaded in nests of tubes.
$C$ = 185 for plates fitted with stay tubes screwed and expanded in bounding rows.
$C$ = 225 for plates fitted with stay tubes screwed, expanded, and beaded in bounding rows.

Plates not exposed to products of combustion:
$C$ = 274 for plates under 7/16 inch in thickness, fitted with screw stays with nuts or welded collars, or stays attached to plates by welding.
$C$ = 190 for plates 7/16 inch and over in thickness, fitted with screw stays with riveted heads.
$C$ = 290 for plates 7/16 inch and over in thickness, fitted with screw stays with nuts or welded collars, or stays attached to plates by welding.
$C$ = 212 for all plates fitted with stays secured by rivets.
$C$ = 340 for plates fitted with through stays with nuts on both inside and outside of plate.
$C_1$ = 175 for plates fitted with through stays with nuts inside and outside and having doubling plates covering the entire supported area.
$C_1$ = 145 for plates fitted with through stays, with nuts inside and outside and reinforced by washers efficiently riveted to the outside of the plate, the diameter of the washers to be not less than two-thirds the pitch of the stays.
$C_1$ = 155 for plates fitted with through stays, with inside and outside nuts and reinforced by doubling strips through which the stays are inserted, the width of the doubling strip to be not less than two-thirds of the pitch of the stays.
$C_1$ = 136 for plates fitted with screw stays and doubling strips between the rows of stays, the width of the doubling strip to be not less than two-thirds of the pitch of the stays.

(6) When a surface is supported by various types of stays for which different coefficients are provided, the average of the two coefficients for adjacent stays shall be used as the value of $C$ or $C_1$ in the formulas.

(7) Riveted heads are not permissible on stays which are screwed into plates having a thickness of less than 7/16 inch. Such stays shall be fitted with nuts or welded collars.

(8) No plate less than 5/16 inch in thickness shall be used in stayed surface construction.

(b) Where two sheets are connected by stays and only one of them requires staying, the value of $C$ or $C_1$ is governed by the thickness of the sheet to be stayed and the types of stays used.

(c) In determining the maximum distance between the center of a bounding line of tubes and the centers of adjacent stays, the value of $C$ or $C_1$ given for the thickness of plate and type of stay or stay tube shall be used.

(d) In determining the maximum distance between a flanged edge and the centers of stays, the pitch which applies to the thickness of the plate and the type of stay may be increased up to 25 percent: *Provided*, That the increment shall not exceed the distance $d$ determined by formula (1) in § 52.30–5.

(e) Where stayed plates are riveted to a flange, the distance from the center of the outermost stays to the center line of the rivets shall not exceed the pitch of the stays: *Provided*, That, where staybolts are adjacent to reinforced edges, such as around furnace doors, bottoms of fire boxes, etc., the maximum allowable pitch may be increased by the diameter of the staybolt hole.

(f) Where stays are fitted at the upper corners of fireboxes or combustion chambers, the distance $d$ from the staybolt nearest the corner to the point of tangency of the corner curve, as shown by figure 52.30–10 (f), shall be determined by the following formula:

$$d=\frac{90T}{D}\sqrt{\frac{C}{2P}} \quad (8)$$

where:

$C$ = applicable coefficient, as provided in paragraph (a).
$d$ = distance from center of staybolt nearest the corner to the point of tangency of the curve.
$T$ = thickness of plate, in sixteenths of an inch.
$P$ = maximum allowable pressure, in pounds per square inch.
$D$ = angle of tangents, in degrees.

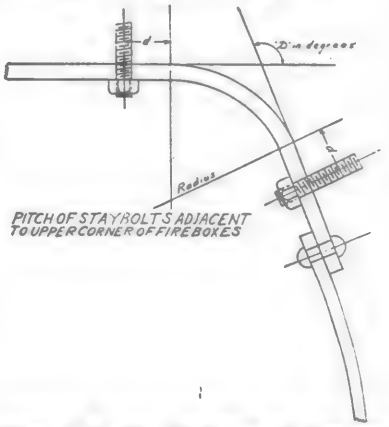



FIGURE 52.30–10 (f)—Pitch of staybolts adjacent to upper corners of fireboxes.

(g) (1) Curved surfaces subject to external pressure and not entirely self-supporting, shall be stayed in accordance with the requirements of this subpart and Subpart 52.35.

(2) Due allowance may be made for the strength inherent in the cylindrical form, except in the case of combustion chamber sheets, by providing that the maximum allowable pressure on a stayed

curved surface shall be the sum of the full pressure computed from formula (1) in this section for stayed plates, plus one-half of the pressure determined by formula (3) for curved plates in § 52.50–10 (b); or the full pressure allowable on the curved plate plus one-half of that allowed on the stayed surface, whichever gives the lower value.

## Subpart 52.35—Stays and Reinforcements

### § 52.35–1 Definitions.

(a) *Through stay.* Through stay is a solid bar extended through both heads of a boiler and threaded at the ends for attachment by means of nuts. With this type of stay the ends are usually upset to compensate for the threading. (See figure 52.35–1(a).)

(b) *Solid screw staybolt.* Solid screw staybolt is a threaded bar screwed through the plates, the ends being riveted over or fitted with nuts or welded collars. (See figures 52.35–1 (b) and 52.35–1 (l).)

(c) *Hollow screw staybolt.* Hollow screw staybolt is a hollow threaded bar screwed through the plate, the ends being riveted over or fitted with nuts or welded collars. (See figure 52.35–1 (c).)

(d) *Flexible staybolt.* Flexible staybolt is a bar made with ball-and-socket joint on one end, the cup of the socket being screwed into the outside sheet and covered with a removable cap, the plain end of the staybolt being threaded, screwed through the inside sheet and riveted over. (See figure 52.35–1 (d).)

(e) *Sling stay.* Sling stay is a flexible stay consisting of a solid bar having one or both ends forged for a pin connection to a crowfoot or other structural fitting secured to the stayed plate. (See figure 52.35–1 (e).)

(f) *Crowfoot.* Crowfoot is a forged fitting with palms or lugs secured to the head to form a proper connection with a sling stay. (See figure 52.35–1 (f).)

(g) *Crowfoot stay.* Crowfoot stay is a solid bar stay terminating in a forged fork with palms or lugs for attachment to the plate. (See figure 52.35–1 (g).)

(h) *Diagonal stay.* Diagonal stay is a bar or formed plate forged with palms or lugs for staying the head of the boiler to the shell diagonally. (See figure 52.35–1 (h).)

(i) *Gusset stay.* Gusset stay is a triangular plate used for the same purpose as a diagonal stay and attached to the head and the shell by angles, flanges, or other suitable means of attachment. (See figure 52.35–1 (i).)

(j) *Dog stay.* Dog stay is a staybolt, one end of which extends through a girder, dog, or bridge, and is secured by a nut, the other end being screwed through the plate which it is supporting and riveted over or fitted with a nut or welded collar. (See figure 52.35–1 (j).)

(k) *Girder.* Girder is a bridge, built up of plates or structural shapes separated by distance pieces, a forging, or a formed plate, which spans an area requiring support, abutting thereon and supporting the girder stays or staybolts. (See figure 52.35–1 (k).)

(l) *Welded collar.* Welded collar is a beveled ring formed around the end of a screw stay by means of arc or gas welding. It is used in lieu of a nut. (See figure 52.35–1 (l).)

(m) *Reinforcement.* Reinforcement is a doubling plate, washer, structural shape, or other form for stiffening or strengthening a plate.

(n) *Stay tube.* Stay tube is a thick-walled tube used in fire-tube boilers to stay the tube sheets.

(o) *Telltale hole.* Telltale hole is a small hole having a diameter not less than 3/16 inch drilled in the center of a solid stay and extending to at least 1/2 inch beyond the inside surface of the sheet.

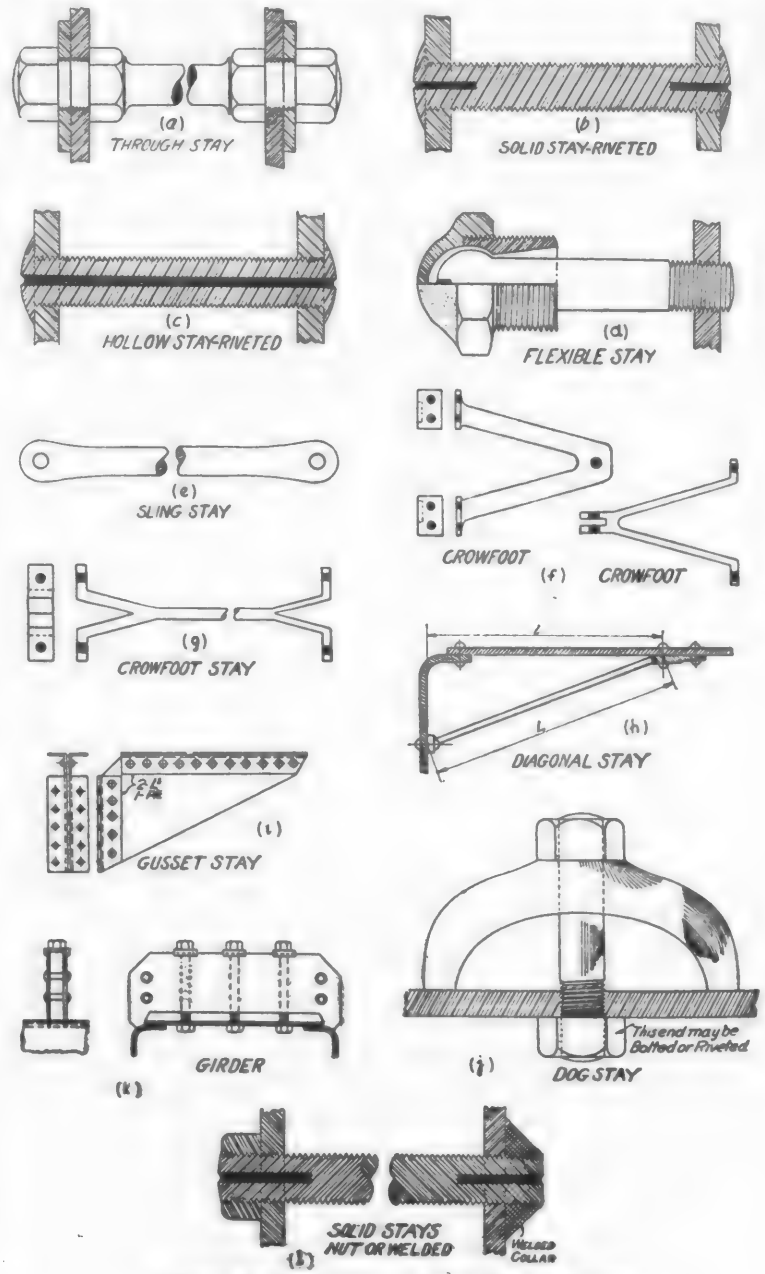



FIGURE 52.35–1—Acceptable types of boiler stays.

§ 52.35–5 Materials.

(a) Round bar stays which require no welding or forging other than upsetting at the ends for threading or to form eyes for use in conjunction with crowfeet, or similar fastenings, shall conform to the requirements of Subpart 51.07, 51.10, or 51.13 of this subchapter.

(b) Crowfeet, lugs, and similar connections for stays shall be forgings without welds conforming to the requirements of Subpart 51.46 of this subchapter.

(c) Forged-welded stays or parts thereof shall conform to the requirements of Subpart 51.13 of this subchapter. All welds in the body of the stay shall be made by the hammer-weld process.

(d) Stiffeners made of structural shapes shall conform to the requirements specified in Subpart 51.10 of this subchapter.

(e) Gusset and diagonal stays made of steel plate, also doubling plates and girders shall conform to the requirements specified in Subpart 51.04 of this subchapter.

(f) Stay tubes shall conform to the requirements of Subpart 51.25 of this subchapter.

(g) Rivets shall conform to the following requirements:

| | |
|---|---|
| Steel rivets | Subpart 51.07 |
| Iron rivets | Subpart 51.13 |

(h) Nuts for screw stays shall be made of steel, conforming to the requirements of Subpart 51.46 or 51.49, or, refined wrought iron, conforming to the requirements of Subpart 51.13 of this subchapter.

§ 52.35–10 Workmanship.

(a) The ends of stay bars and stay tubes which are upset for threading shall be subsequently annealed.

(b) Holes for screw staybolts shall be drilled and tapped fair and true and shall have a full thread.

(c) All holes for rivets shall be drilled and shall be slightly counter-sunk in order to form a fillet at point and head. Rivets shall be of sufficient length to fill the rivet holes completely and to form a head of proportionate strength to the body of the rivet.

(d) Holes for tubes or through stays may be made by punching a pilot hole in the center, but shall be machined to size by a rotating cutter, or otherwise be drilled from the solid plate.

(e) When jointed longitudinal stays are fitted between the back and front tube plates and connected by pins, such pins may be fitted slack in the holes, but the total clearance on both ends shall not exceed 1/16 inch.

(f) Where stay tubes are used for supporting flat surfaces they shall be fitted with threads at both ends, screwed into the tube sheets and rolled tight with expanders, in addition to which they may be beaded. Making such tubes tight by calking is not permissible.

§ 52.35–15 Computations.

(a) The maximum allowable pressure and the required area of direct stays shall be computed by the following formulas (in making computations, the least sectional area of the stay shall be taken):

$$P = \frac{aC}{A} \quad (1)$$

$$a = \frac{PA}{C} \quad (2)$$

where:

$P$ = maximum allowable pressure, in pounds per square inch.
$A$ = area supported by the stay, in square inches.
$a$ = required cross-sectional area of stay, in square inches.
$C$ = coefficients based on the minimum tensile strength of the material used, as follows:
- $C$ = 10,000 for solid steel through stays.
- $C$ = 9,000 for solid steel screw stays having diameters of 1 inch and above.
- $C$ = 9,000 for jointed steel stays.
- $C$ = 8,000 for solid or hollow steel screw staybolts having diameters of 1 inch or less.
- $C$ = 8,000 for refined wrought-iron stays or staybolts having diameters of 1 inch and above.
- $C$ = 8,000 for steel stays formed from plates without welds.
- $C$ = 7,500 for wrought-iron or steel stay tubes.
- $C$ = 7,500 for flexible screw staybolts.
- $C$ = 7,500 for refined wrought-iron screw staybolts having diameters less than 1 inch.
- $C$ = 6,000 for welded refined wrought-iron stays.

(b) In computing the gross area supported by a stay, the pitch of the stays shall be used, but the least sectional area of the stay may be deducted therefrom to obtain the net area.

(c) Where stays are adjacent to the outer edge of the surface to be stayed and special allowances are made for the spacing, the area $A$ shall be determined by deducting such parts of the surface as may be considered self-supporting in accordance with § 52.30–5.

(d) The required cross-sectional area of a diagonal stay shall be determined by the following formula:

$$a_1 = \frac{aL}{l} \quad (3)$$

where:

$a_1$ = required area of diagonal stay, in square inches.
$a$ = required area of direct stay computed by formula (2) in this section, in square inches.
$L$ = length of diagonal stay as shown by figure 52.35–1 (h), in inches.
$l$ = length of line drawn at right angles to the surface to be supported, and extending to the center of the first rivet in the diagonal stay as shown by figure 52.35–1(h), in inches.

(e) The minimum sectional area of a gusset stay constructed of triangular plates secured to single or double rolled shapes along the two sides, shall be 10 percent greater than that determined by formula (3) in this section for diagonal stays.

(f) In determining the net cross-sectional area of drilled or hollow staybolts, the cross-sectional area of the hole shall be deducted if the diameter exceeds 3/16 inch.

(g) Where a cylindrical shell is pierced by more than three holes for stays or other purposes on a line parallel with the axis of the shell, the relative strength of the ligaments between such holes shall not be less than that of the ligaments in the outer row of rivets in the longitudinal joint. If the construction necessitates a lower relative strength, this must be used for the value of $E$ in the formula (1), (2), or (3) in § 52.05–10, for determining the maximum allowable pressure or minimum thickness of plate.

(h) The minimum sectional area of a pin subject to double shear shall be at least 80 percent of the required cross-sectional area of the stay.

(i) Each branch of a crowfoot or similar component part of a divided stay shall be proportioned to support at least two-thirds of the entire load.

(j) Eyes for pin connections shall be properly formed to the body of the stays. The minimum outside diameter of the eye shall be one and one-fourth times that of the pin. The minimum thickness of a single eye shall be the diameter of the pin; that of the double eye shall be two-thirds of the diameter of the pin; the cross-sectional area of any part of an eye shall be such that the two sides of a single eye shall equal at least one and one-fourth, and the four sides of a forked eye shall equal at least one and one-half times the strength of the body of a stay.

(k) The strength of the rivets connecting crowfoot braces, or any other type of reinforcement, shall equal one and one-half times the strength of the connecting stay.

(l) Palms, lugs, or flanges which are to be riveted, shall have a minimum width at the rivet hole exceeding the diameter of the rivet head, and shall have a cross-sectional area exclusive of the rivet hole not less than one and one-fourth times the required cross-sectional area of the body of the stay. Where there are two or more rivets located in the longitudinal axis of the stay, the strength of the palm or lug at the second or subsequent rivet hole may be reduced to not less than one and one-fourth times the combined strength of the rivet at that point and those beyond.

§ 52.35–20 Detail requirements.

(a) All screw staybolts, except flexible staybolts, shall have a telltale hole in the center of each end not less than 3/16 inch diameter extending not less than 1/2 inch beyond the inside of the plate.

(b) Joining of steel stays in the body by any process of welding is not permissible.

(c) The length of screw staybolts shall not exceed 20 diameters.

(d) Where the length of a boiler exceeds 18 feet, the through stays shall be supported in the middle.

(e) Where the heads of screw staybolts are riveted over, the end of the staybolt before riveting shall extend not less than 1/4 inch from the surface of the plate to provide sufficient material for a substantial head.

(f) Arc welding may be used in lieu of threading or riveting for the attachment of stays or staybolts to plates in conformance with the following requirements:

(1) The stays or staybolts shall be inserted into holes through the plate, ex-

cept as provided for in subparagraph (5) of this paragraph, and the area of the weld in shear measured parallel to that portion of the stay extending through the plate shall be not less than 1.25 times the required cross-sectional area of the stay, but in no case shall the leg of the weld be less than ⅜ inch.

(2) The face of the weld shall not terminate below the outside surface of the plate.

(3) The ends of the stays or staybolts inserted through the plate shall not project more than ⅜ inch beyond surfaces exposed to the products of combustion.

(4) When flat heads are supported by diagonal stays protruding through the shell, the cross-sectional area of the portion of the stay extending through the shell shall not be less than 1.25 times the required cross-sectional area of the stay.

(5) Diagonal stays may be attached to the inner surface of the shell, but not the head, by fillet welds only, provided:

(i) The leg of the welds is not less than ⅜ inch;

(ii) The cross-sectional area of the portion of the stay welded to the shell and also the cross-sectional area of the fillet welds parallel to the axis of the shell, measured at the throat, are not less than 1.25 times the cross-sectional area of the stay;

(iii) The fillet welds shall be continuous around the full length of the sides and ends of the stay; and,

(iv) The palm end of the stay shall be hot formed to the radius of curvature of the shell.

(6) If the stay or staybolt is not normal to the plate, the point where the projection of the longitudinal center line of the stay or staybolt intersects the inner surface of the plate shall fall within the outer boundaries of the weld (projected if necessary).

(7) Welded collars may be used in lieu of nuts to attach screw staybolts to plates, provided the legs of the welds are of sufficient length to develop a strength of at least 25 percent of the staybolt, but in no case shall the legs of the welds be less than ¼-inch in length.

(8) The welding, except where welded collars are used, shall be stress-relieved in accordance with § 56.01–70 of this subchapter.

(9) Telltale holes are not required in stays or staybolts attached by welding, except where screw staybolts are used.

(g) The minimum thickness of nuts used in connection with screw stays shall be one-half of the diameter of the stay, but in no case less than ¾ inch. The stays shall be so placed in relation to the joints that the plates can be calked without removing the nuts.

(h) Nuts shall not be fitted to staytubes at the combustion chamber end.

(i) The ends of stays fitted with nuts shall not be exposed to the direct radiant heat of the fire.

(j) The minimum thickness of staytubes measured at the root of the threads shall be ¼ inch for marginal staytubes and $\frac{7}{16}$ inch for other staytubes.

## Subpart 52.40—Tube Sheets of Water-Tube Boilers

### § 52.40–1 Definitions.

(a) *Curved tube sheet.* Curved tube sheet is a section of the shell of a boiler drum formed to an arc of a circle and perforated for nests of tubes.

(b) *Flat tube sheet.* Flat tube sheet is the tube plate of box headers of certain types of water-tube boilers.

(c) *Longitudinal ligament.* Longitudinal ligament is the minimum section of metal between two tube holes on a line parallel with the axis of the drum.

(d) *Circumferential ligament.* Circumferential ligament is the minimum section of metal between two tube holes on a line around the circumference of the drum.

(e) *Diagonal ligament.* Diagonal ligament is the minimum section of metal between two tube holes in adjacent rows, measured diagonally from one row to the other.

### § 52.40–5 Computations for curved tube sheet.

(a) The maximum allowable pressure and minimum thickness of a cylindrical shell pierced for tubes and of a curved tube sheet shall be calculated by formula (1), (2), or (3) of § 52.05–10, using the lowest value of $E$, determined in accordance with this section.

(b) (1) Where cylindrical shells are pierced by a single row of tubes or by two or more rows so placed in the cylindrical shell as not to be considered nests of tubes, as in a double buttstrap joint, or where reinforcing plates are fitted, the ligament efficiency between tube holes shall be computed by formula (1) of this section. For tube rows other than those placed on the longitudinal joint, the shell if necessary shall be either reinforced or increased in thickness.

(2) The relative strength of the ligaments between tube holes which come in a single line in a buttstrap joint or reinforced shell, shall be computed by the following formula:

$$E=\frac{(p-d)\,T_1}{pT} \qquad (1)$$

where:

$E$ = relative strength of ligament.
$p$ = pitch of tubes, in inches.
$d$ = diameter [1] of tube holes, in inches.
$T$ = thickness of shell, in inches.
$T_1$ = the aggregate thickness of the two buttstraps, or the shell and reinforcing plate, in inches.

[1] Where the tube hole is not of the straight bore type, the equivalent diameter shall be calculated by dividing the cross-sectional area of the removed metal by the material thickness.

(c) When a shell is pierced for tubes in a series of rows parallel to its axis, the efficiency of the ligament between the tube holes in any row shall be determined as follows:

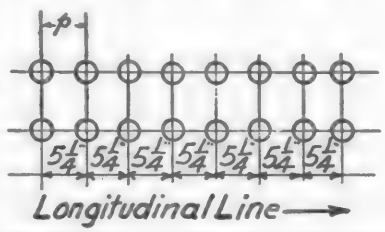



FIGURE 52.40–5 (c1)—Example of tube spacing with pitch of holes equal in every row.

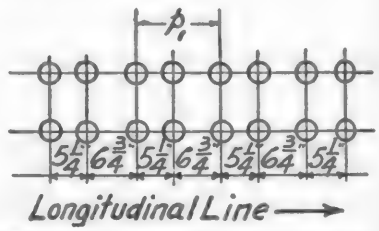



FIGURE 52.40–5 (c2)—Example of tube spacing with pitch of holes unequal in every second row.

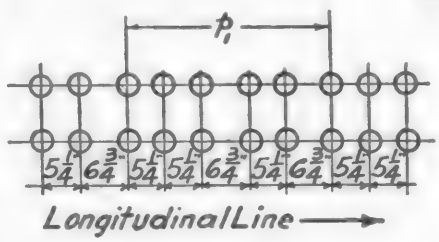



FIGURE 52.40–5 (c3)—Example of tube spacing with pitch of holes varying in every second and third row.

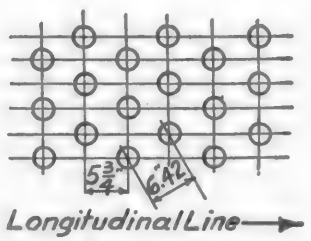



FIGURE 52.40–5 (c4)—Example of tube spacing with holes on diagonal lines.

(1) When the pitch of the tube holes in any row is uniform. (See figure 52.40–5 (c1).)

$$E=\frac{p-d}{p} \qquad (2)$$

(2) When the pitch of the tube holes in any row is not uniform. (See figures 52.40–5 (c2) and 52.40–5 (c3).) The calculations shall be made for a section of the row not exceeding the diameter of the shell.

$$E=\frac{p_1-nd}{p_1} \qquad (3)$$

(3) When the holes in one row are placed so as to form diagonal ligaments with the holes in an adjacent row. (See figure 52.40–5 (c4).) The efficiency of these ligaments shall be taken from the

diagram figure 52.40–5(c5). To use this diagram compute the value of $\frac{p_d}{p}$ and also the efficiency of the longitudinal ligament. Next find in the diagram, the vertical line corresponding to the longitudinal efficiency of the ligament and follow this line vertically to the point where the diagonal line representing the ratio of $\frac{p_d}{p}$ intersects. By projecting this line horizontally to the left on the edge of the diagram, the diagonal efficiency of the ligament may be read from the scale. If this efficiency is less than that of the longitudinal ligament it shall be used in computing the allowable pressure.

(4) The symbols used in the formulas in this paragraph mean:

$E$ = relative strength of the ligament.
$p$ = longitudinal pitch of tube holes, in inches.
$p_d$ = diagonal pitch of tube holes, in inches.
$p_1$ = unit length of section of the row considered, in inches.
$d$ = diameter[3] of tube holes, in inches.
$n$ = number of tube holes in section $p_1$.

[3] Where the tube hole is not of the straight bore type, the equivalent diameter shall be calculated by dividing the cross-sectional area of the removed metal by the material thickness.

(d) The pitch of the tube holes shall be measured either on the flat plate before rolling or on the middle line of the plate after rolling.

(e) The strength of the circumferential ligaments between tube holes shall be at least one-half the required strength of the longitudinal ligaments.

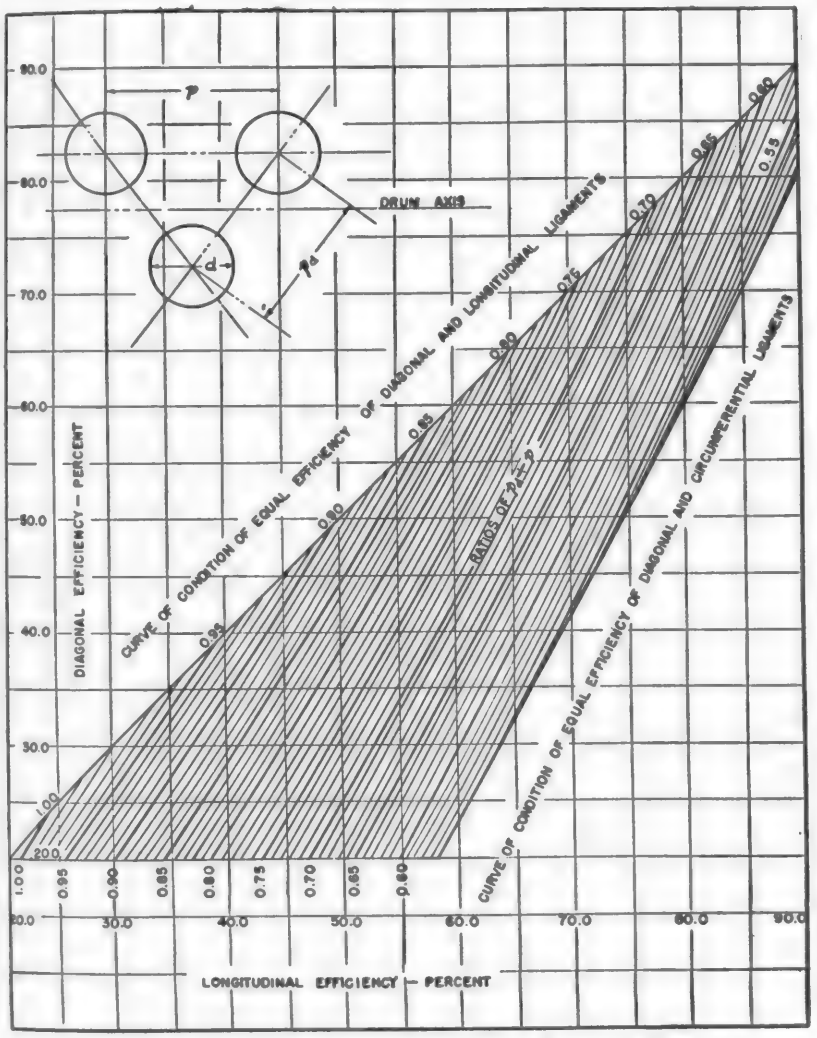



FIGURE 52.40–5 (c5)—Diagrammatic computation of diagonal efficiency.

(f) When the tube holes are not normal to the plate, the plate thickness shall be sufficient to provide a parallel seating not less than ⅜ inch depth between planes at right angles with the axis of the tube for tubes 2½ inches in diameter and under; for tubes having diameters over 2½ inches, the depth of the parallel seating shall not be less than ½ inch.

**§ 52.40–10 Reinforcement of ligaments.**

(a) Where reinforcing plates are applied to the drums of water-tube boilers to strengthen the shell at the point where the tubes enter, they shall be riveted to the shell, and where outside calking is used, the tubes shall be expanded into the inner and outer plates so that the rivets and tubes will hold the plates together in accordance with the regulations for stayed surfaces.

(b) The rivet spacing with respect to the tubes shall conform to the requirements of Subparts 52.30 and 52.35, using a value of 250 for $C$, and shall be based on a unit pressure equal to the pressure that can be carried by the inner plate with a factor of safety of 5. The shearing strength of the rivets securing the reinforcing plate on each side of the tube line shall be at least equal to the required strength of the ligament of the reinforcing plate between the tubes.

(c) The combined drum shell and reinforcing plate or plates, and riveted connections, shall have a factor of safety of not less than 5 in the ligaments when calculated in accordance with § 52.40–5. When reinforcing plates or butt-straps are exposed to the products of combustion, the joints shall be protected therefrom.

**§ 52.40–15 Unsymmetrical ligaments.**

(a) When tubes or holes are unsymmetrically spaced, the average ligament efficiency shall be not less than that required by this section, which applies to ligaments between tube holes and not to single openings. When this procedure results in lower efficiencies than those for symmetrical groups which extend a distance greater than the inside diameter of the shell as covered by § 52.40–5, the efficiencies computed by § 52.40–5 may be used.

(b) For a length equal to the inside diameter of the shell for the position which gives the minimum efficiency, the efficiency shall be not less than that on which the maximum allowable pressure is based.

(c) For a length equal to the inside radius of the shell for the position which gives the minimum efficiency, the efficiency shall be not less than 80 percent of that on which the maximum allowable pressure is based.

(d) For holes placed longitudinally along a shell but which do not come in a straight line, the requirements of this section shall apply, except that the equiv-

alent longitudinal width of a diagonal ligament shall be used. To obtain the equivalent width the longitudinal pitch of the two holes having a diagonal ligament shall be multiplied by the efficiency of the diagonal ligament. The efficiency to be used for the diagonal ligaments is given in figure 52.40–15 (d).

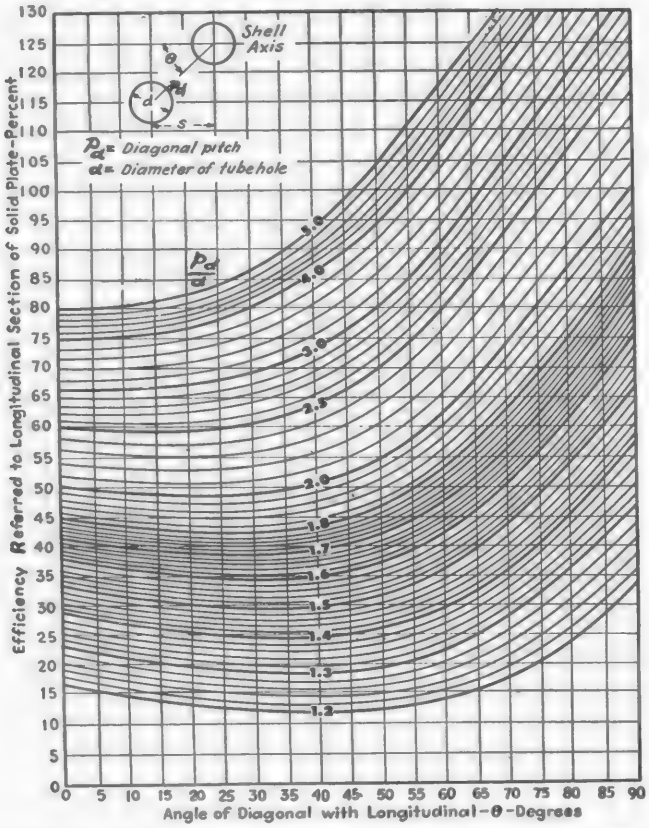



FIGURE 52.40–15 (d)—Diagram for determining efficiency of diagonal ligaments in order to obtain equivalent longitudinal efficiency.

## Subpart 52.45—Combustion Chambers and Tube Sheets of Fire-Tube Boilers

### § 52.45–1 Definitions.

(a) *Combustion chamber.* Combustion chamber, within the meaning of this section, is that part of an internally fired boiler in which combustible gases may be burned after leaving the furnace.

(b) *Separate combustion chamber.* Separate combustion chamber is a combustible chamber which is connected to one furnace only.

(c) *Common combustion chamber.* Common combustion chamber is a combustion chamber connected to two or more furnaces in a boiler.

(d) *Crown or top plate.* Crown or top plate is the top of a combustion chamber and is usually supported by girder stays or by sling stays or braces.

(e) *Wrapper sheet.* Wrapper sheet is the side plate of any type of combustion chamber and also the bottom plate of a common combustion chamber.

(f) *Curved bottom plate.* Curved bottom plate is the bottom of a separate combustion chamber formed to an arc of a circle and usually designed to be self-supporting.

(g) *Combustion chamber tube sheet.* Combustion chamber tube sheet is the plate forming the end of a combustion chamber in which the tubes are secured.

(h) *Combustion chamber back sheet.* Combustion chamber back sheet is the plate opposite the tube sheet forming the back of the combustion chamber. It is usually stayed to the back head of the boiler by means of screw stay bolts, or, in the case of double-ended boilers, to the back of the combustion chamber of the other end of the boiler.

(i) *Structural stiffeners.* Structural stiffeners are rolled shapes or flanged plates which are used to stiffen a surface which is not entirely self-supporting.

### § 52.45–5 Materials.

(a) All plates forming parts of combustion chambers or fireboxes shall conform to the general specifications for the shell plates.

(b) Structural shapes of any form used for stays and reinforcements shall conform to the requirements of Subpart 51.10 of this subchapter.

### § 52.45–10 Computations.

(a) *Formulas.* The maximum allowable pressure and minimum thickness of all stayed parts of combustion chambers shall be computed in accordance with formulas provided in Subparts 52.30 and 52.35, except as follows:

(b) *Tube sheets.* (1) When the crown plate of a combustion chamber is supported by girders, transmitting the load to the tube plate and back sheet, thus subjecting the ligaments of the tube sheet to a compressive stress, the maximum allowable pressure shall be determined by formulas in Subparts 52.30 and 52.35, but shall not exceed that given by the following formula:

$$P=\frac{2CT(p-d)}{Lp} \quad (1)$$

nor shall the thickness be less than that given by formula:

$$T=\frac{LpP}{2C(p-d)} \quad (2)$$

where:

$P$ = maximum allowable pressure, in pounds per square inch.
$p$ = least horizontal pitch of tubes, in inches.
$L$ = total length of combustion chamber over the tube sheet and back sheet, in inches.
$T$ = thickness of tube plate, in inches.
$C$ = 13,300 the allowable crushing stress in pounds per square inch.
$d$ = inside diameter of plain tubes, in inches.

(2) Where tubes are staggered, the vertical distance between the center lines of tubes in adjacent rows shall not be less than

$$\tfrac{1}{2}\sqrt{2dp+d^2} \quad (3)$$

(c) *Curved bottom plate without reinforcement.* (1) The maximum allowable pressure and minimum thickness of curved bottoms of separate combustion chambers without reinforcement shall be computed by the following formulas:

$$P=\frac{26}{R}(300T-1.03L) \quad (4)$$

$$T=\frac{\frac{PR}{26}+1.03L}{300} \quad (5)$$

(d) *Curved bottom plate with reinforcement.* (1) When the bottoms of combustion chambers are reinforced by structural stiffeners, such as angle or T bars, the minimum thickness of such bars shall be equal to 80 percent of the thickness of the plate reinforced, and the depth of web shall be equal to at least one-half the pitch of the stiffeners. The maximum allowable pressure and minimum thickness shall be computed by the following formulas:

$$P=\frac{(480T)^2}{2RL} \quad (6)$$

$$T=\frac{\sqrt{2RLP}}{480} \quad (7)$$

(2) The spacing and size of the rivets attaching the stiffeners to the plates shall comply with the requirements of Subparts 52.30 and 52.35, for stayed surfaces.

(e) *Symbols.* The symbols to be used in connection with the formulas in paragraphs (c) and (d) of this section are:

$P$=maximum allowable pressure, in pounds per square inch.
$T$=thickness of plate, in inches.
$R$=external radius to which plate is formed, in inches.
$L$=length of plate between supports measured on a line parallel to the axis of the boiler, in inches.

(f) *Girders or crown bars.* The maximum allowable pressure and the minimum thickness of crown bars or girders supporting the tops of combustion chambers shall be computed by the following formulas:

$$P=\frac{Cd^2T}{(L-p_2)p_1L} \quad (8)$$

$$T=\frac{PLp_1(L-p_2)}{Cd^2} \quad (9)$$

where:

$P$=maximum allowable pressure, in pounds per square inch.
$L$=length of girder between supports (from inside of tube sheets to inside of combustion chamber back plate), in inches.
$p_1$=pitch between girders from center to center, in inches.
$p_2$=pitch of supporting bolts, in inches. (Not to exceed maximum allowable pitch for plate thickness; see subpart 52.30.)
$d$=depth of girder, in inches.
$T$=thickness of girder, in inches (aggregate thickness where girder consists of 2 plates).
$C$=6,800 where girder is fitted with one supporting bolt.
$C$=10,300 where girder is fitted with two or three supporting bolts.
$C$=11,400 where girder is fitted with four or five supporting bolts.
$C$=12,200 where girder is fitted with six or more supporting bolts.

### § 52.45–15 Detail requirements.

(a) Where structural steel shapes or forged fittings are used to form connections between stays and plates that are not self-supporting, the eyes for rivet or pin connections in such fastenings shall comply with the requirements of § 52.35–15.

(b) Curved bottoms of common combustion chambers shall be considered a flat surface and stayed in accordance with the requirements of Subparts 52.30 and 52.35.

(c) When plates are flanged to form the combustion chamber and back connections, the minimum inner radius shall be not less than one and one-half times the thickness of the plate flanged.

## Subpart 52.50—Furnaces and Flues

### § 52.50–1 Definitions.

(a) *Furnace.* Furnace, within the meaning of this subpart, is a firebox or a large flue in which the fuel is burned.

(b) *Corrugated furnace.* Corrugated furnace is a cylindrical shell wherein

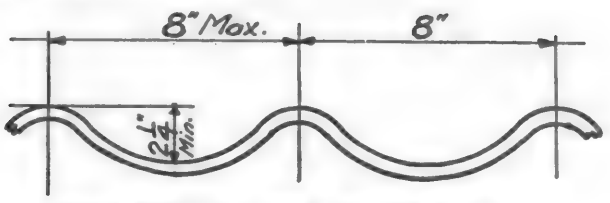



FIGURE 52.50–1 (b1)— Leeds suspension bulb furnace.

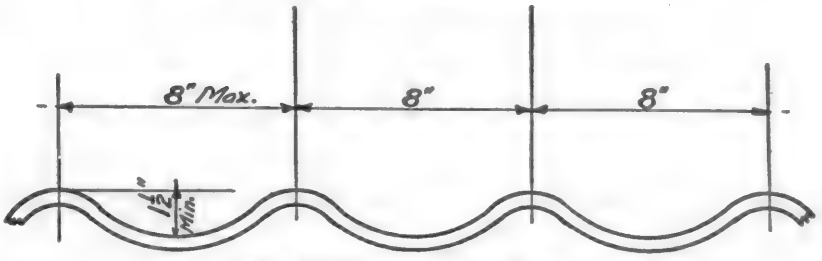



FIGURE 52.50–1 (b2)—Morison furnace.

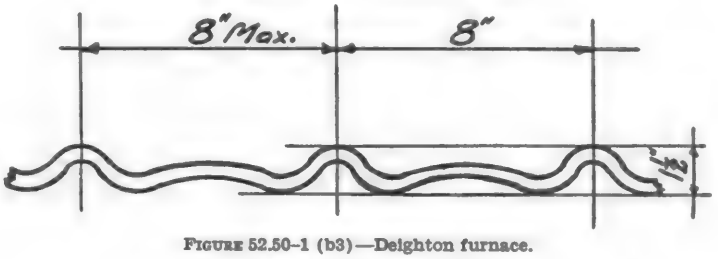



FIGURE 52.50–1 (b3)—Deighton furnace.

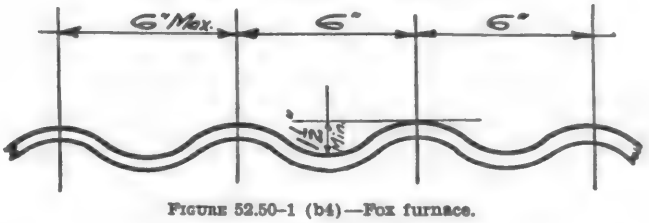



FIGURE 52.50–1 (b4)—Fox furnace.

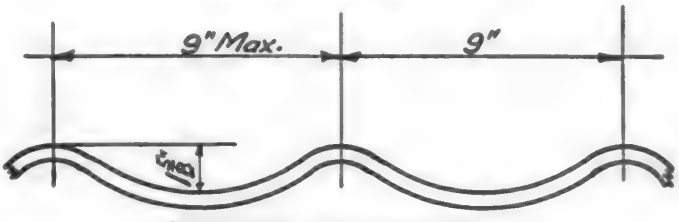



FIGURE 52.50–1 (b5)—Brown furnace.

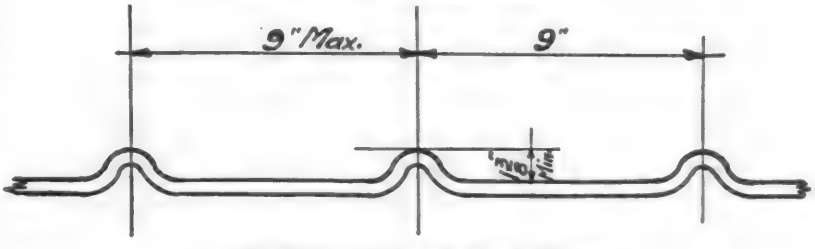



FIGURE 52.50–1 (c)—Purves ribbed furnace.

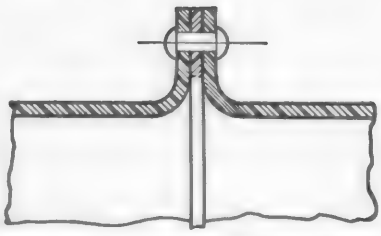


FIGURE 52.50–1 (d)—Adamson ring furnace.

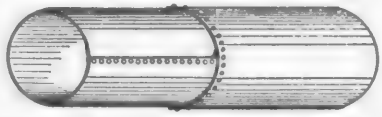


FIGURE 52.50–1 (e)—Circular riveted flue.

corrugations are formed circumferentially for additional strength and to provide for expansion. (See figures 52.50–1 (b1), 52.50–1 (b2), 52.50–1 (b3), 52.50–1 (b4), and 52.50–1 (b5).)

(c) *Purves ribbed furnace.* Purves ribbed furnace is a cylindrical shell in which ribs or projections are formed circumferentially to provide additional strength. (See figure 52.50–1 (c).)

(d) *Adamson ring furnace.* Adamson ring furnace is a cylindrical shell made in short sections, the ends of the sections being flanged and riveted together through a reinforcing ring. (See figure 52.50–1 (d).)

(e) *Plain furnace.* Plain furnace is a cylindrical shell usually made in sections joined by means of riveting or welding. (See figure 52.50–1 (e).)

(f) *Flues.* Flues are cylindrical shells made of seamless or welded tubing, or with a riveted longitudinal joint, the ends being attached by riveting or welding. Their purpose is to provide additional heating surface and to form a path for the products of combustion. (See figure 52.50–1 (e).)

### § 52.50–5 Materials.

(a) Steel plate used in the fabrication of furnaces or flues shall be of firebox quality and shall conform to the specifications and requirements for shell plates.

(b) Seamless, lap welded or electric resistance welded flues may be made of pipe complying with Subpart 51.34 of this subchapter.

### § 52.50–10 Computations.

(a) *Corrugated or ribbed furnaces.* (1) The maximum allowable pressure and minimum thickness of corrugated or ribbed furnaces shall be computed by the following formulas:

$$P=\frac{CT}{D} \quad (1)$$

$$T=\frac{DP}{C} \quad (2)$$

where:

$P$ = maximum allowable pressure, in pounds per square inch.
$T$ = minimum thickness of plate, in inches.
$D$ = external diameter of furnace at bottom of corrugations, in inches.
$C$ = coefficients, as follows:
- $C$ = 15,700 for Leeds suspension bulb furnace.
- $C$ = 14,700 for Morison or Deighton furnace.
- $C$ = 12,500 for Fox, Purves, or Brown furnace.

(2) The spacing and depth of the corrugations shall be in accordance with figures 52.50–1 (b1), 52.50–1 (b2), 52.50–1 (b3), 52.50–1 (b4), 52.50–1 (b5), and 52.50–1 (c), as shown in § 52.50–1. New furnaces shall be rolled to practically a true circle. The maximum distortion permissible from the true circle shall not exceed ¼ inch, and all new furnaces shall be measured by an inspector to ascertain that this tolerance has not been exceeded.

(b) *Adamson ring or plain furnaces.* The maximum allowable pressure and minimum thickness of furnaces of the Adamson ring or plain cylindrical types shall be computed by the following formulas:

$$P=\frac{52}{D}(300T-1.03L) \quad (3)$$

$$T=\frac{\frac{PD}{52}+1.03L}{300} \quad (4)$$

where:

$P$ = maximum allowable pressure, in pounds per square inch.
$D$ = external diameter of furnace shell, in inches.
$L$ = length of a section for Adamson ring furnaces or riveted flues, or total length between centers of head rivet seams where the flues are made without circumferential joints, in inches.
$T$ = thickness of plate, in inches.

(c) *Flues.* (1) The maximum allowable pressure and minimum thickness of plain riveted flues shall be computed by formulas (3) and (4) provided in paragraph (b) of this section. For seamless or welded flues not less than 6 nor more than 18 inches in outside diameter and subject to external pressure, the following formulas shall be used:

$$P=\frac{86670T-1386D}{5D} \quad (5)$$

$$T=\frac{D(5P+1386)}{86670} \quad (6)$$

where:

$P$ = maximum allowable pressure, in pounds per square inch.
$T$ = thickness of flue, in inches.
$D$ = external diameter of flue, in inches.

(2) As a matter of convenience, table 52.50–10 is computed from the preceding formulas for seamless or welded flues.

TABLE 52.50–10—MAXIMUM ALLOWABLE PRESSURE AND MINIMUM THICKNESS OF SEAMLESS OR WELDED FLUES SUBJECT TO EXTERNAL PRESSURE

| Outside diameter of flue, inches | Maximum allowable pressure in pounds per square inch | | | | | | |
|---|---|---|---|---|---|---|---|
| | 100 | 120 | 140 | 160 | 180 | 200 | 220 |
| | Thickness of flue (inches) | | | | | | |
| 6 | 0.130 | 0.137 | 0.114 | 0.151 | 0.158 | 0.165 | 0.172 |
| 7 | .152 | .161 | .169 | .177 | .185 | .193 | .201 |
| 8 | .174 | .184 | .193 | .202 | .211 | .221 | .229 |
| 9 | .196 | .206 | .217 | .228 | .238 | .248 | .258 |
| 10 | .218 | .229 | .241 | .253 | .264 | .276 | .287 |
| 11 | .239 | .252 | .265 | .278 | .290 | .303 | .316 |
| 12 | .261 | .275 | .289 | .303 | .317 | .331 | .344 |
| 13 | .283 | .298 | .313 | .328 | .343 | .359 | .373 |
| 14 | .305 | .321 | .337 | .354 | .369 | .386 | .402 |
| 15 | .326 | .344 | .361 | .379 | .396 | .414 | .430 |
| 16 | .348 | .367 | .385 | .405 | .422 | .441 | .459 |
| 17 | .370 | .390 | .409 | .430 | .448 | .469 | .488 |
| 18 | .392 | .413 | .433 | .455 | .475 | .497 | .516 |

### § 52.50–15 Detail requirements.

(a) The minimum thickness of furnaces shall be 5/16 inch, and the maximum thickness of furnaces shall be 13/16 inch. When the frabricated thickness of a furnace exceeds 13/16 inch, acceptance of the furnace will be given special consideration by the Commandant.

(b) Where furnaces are constructed with riveted joints, the minimum efficiency of such joints shall not be less than 50 percent of the solid plate. Such joints may be of the lap-riveted type provided the furnace does not exceed 36 inches in length or height. All longitudinal riveted joints shall be located at the bottom of the furnace or flue.

(c) The thickness of corrugated and ribbed furnaces shall be ascertained by actual measurements taken by an inspector. Such furnaces shall be drilled by the manufacturer for a ⅜-inch pipe tap and fitted with a screw plug which can be removed by the inspector when taking measurements, the plug to be located as follows:

(1) *For Leeds, Morison, Deighton, Fox, and Brown types of furnaces.* At the crest of the waterside corrugation, not less than four corrugations from either end.

(2) *For Purves ribbed furnaces.* At the center of the second flat from either end.

(3) *Test plug.* Furnaces shall be installed so that the test plug is located at the bottom.

(d) (1) Adamson ring furnaces shall be made in sections not less than 18 inches and not more than 24 inches in length. They shall be flanged with a radius measured on the fire side of not less than three times the thickness of the plate and the flat portion of the flange outside of the radius shall be at least three times the diameter of the rivet holes.

(2) The distance from the edge of the rivet holes to the edge of the flange shall be not less than the diameter of the rivet holes and the diameter of the rivets before driving shall be at least ¼ inch larger than the thickness of the plate.

(3) The depth of the reinforcing ring between the flanges shall be not less than three times the diameter of the rivet holes and the ring shall be substantially riveted to the flanges.

(4) The fire edge of the ring shall terminate at or outside the point of tangency to the curve of the flange and the thickness of the ring shall be not less than ½ inch.

(e) When furnaces are flanged for attachment to the front head or rear tube sheet, the minimum inner radius shall be not less than twice the thickness of the furnace plate flanged.

(f) Where externally fired boilers are fitted with flues exceeding 5 inches in diameter the minimum water space between the flues and/or between the wall of a flue and the shell of the boiler, shall not be less than 3 inches, measured at the middle of the flue.

(g) Plain or corrugated furnaces may be constructed by arc welding. The longitudinal and circumferential joints shall be of the double-welded butt type, and the following modifications in the

requirements for Class I welded pressure vessels will be acceptable:

(1) The customary test plates need not be furnished, provided each furnace has sufficient material left on one end to obtain two guided side bend specimens, which shall not be detached until all the work and heat treatment on the furnace has been completed. One retest will be permitted for each specimen failing to meet the specified requirements.

(2) Radiographic examination of the furnace seam is not required, but will be accepted in lieu of the guided side bend specimens. If radiographs are taken, they shall meet the requirements of § 56.05–5 of this subchapter except that the films will not be retained by the Coast Guard.

## Subpart 52.55—Boiler and Superheater Tubes

### § 52.55–1 Definitions.

(a) *Tubes.* Tubes, within the meaning of this subpart, are cylindrical shells of comparatively small diameter constituting the main part of the heating surface of a boiler or superheater.

(b) *Safe end.* Safe end is a short piece of boiler tube which is usually thicker than the ordinary tube and is welded to a tube of lighter gauge for the purpose of lengthening it.

(c) *Seamless tube.* Seamless tube is a tube without any longitudinal joint.

(d) *Electric-resistance-welded tube.* Electric-resistance-welded tube is a tube the longitudinal joint of which is made by the electric-resistance butt welding process and the tube is required to be normalized after welding.

(e) *Stay tube.* Stay tube is a thick-walled tube, the end of which is usually thickened by upsetting to compensate for threading. Such tubes are used for staying tube sheets into which they are screwed and expanded.

(f) *Expanding.* Expanding is the process of enlarging the end of a tube to make it fit tightly in the tube sheet.

(g) *Beading.* Beading is the process of turning over the protruding end of a tube after expanding to form a supporting collar for the tube sheet.

(h) *Bell-mouthing.* Bell-mouthing is the process of flaring the end of a tube beyond where it is expanded in the tube sheet.

### § 52.55–5 Materials and workmanship.

(a) Seamless steel boiler tubes shall comply with the requirements of Subpart 51.25 of this subchapter for such tubes.

(b) Electric-resistance-welded steel and iron boiler tubes shall comply with the requirements of Subpart 51.25 of this subchapter for such tubes.

(c) Tube holes shall be drilled full size in the solid plate. Tube holes may be counterbored where the metal is thicker than that required to obtain a proper bearing by expanding, so as to form narrow seats into which the tube ends can be properly expanded, provided there is space available to permit a proper amount of flare of the tube end.

(d) (1) The ends of tubes of fire-tube boilers shall be rolled tight in the tube sheet and the ends shall be beaded over; or the ends rolled, beaded and seal-welded around the edge of the bead; or the ends rolled and strength welded.

(2) Tube ends attached by rolling and strength welding shall comply with the following requirements:

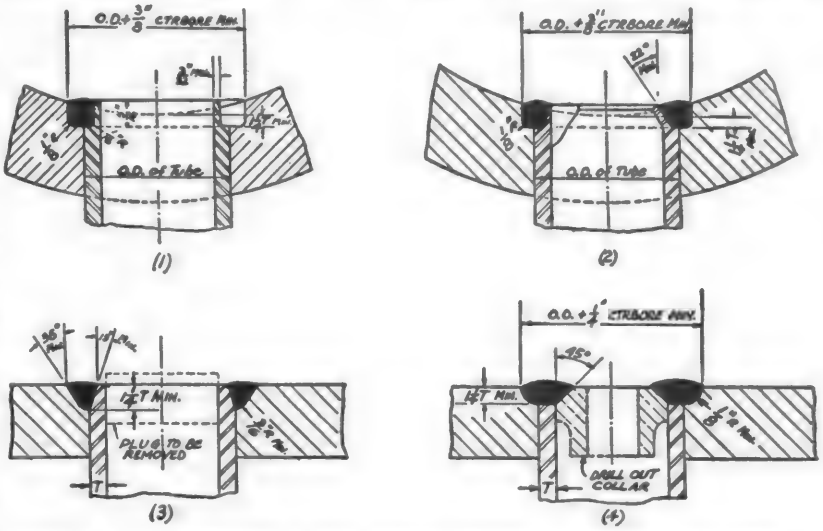



FIGURE 52.55–5(f)—Acceptable types of welded attachments of boiler tubes to headers.

(i) Where a bevel or chamfer is employed, the tube sheet shall be machined to a depth at least equal to the thickness of the tubes or ⅛ inch, whichever is greater, and not to exceed one-third of the tube sheet thickness. The projection of the tube beyond the tube sheet shall not exceed a distance equal to the tube thickness, and in no case more than one-third of the tube sheet thickness or ⅛ inch, whichever is greater.

(ii) Where no bevel or chamfer is employed, the tube shall extend beyond the tube sheet not less than a distance equal to 1¼ times the tube thickness, nor more than twice the tube thickness, but in no case shall the distance be less than ⅛ inch nor more than ¼ inch.

(iii) When any type of welded attachment is employed, the tube shall be rolled before welding and again rolled lightly after welding.

(3) The inner surface of tube holes in any form of attachment may be grooved or chamfered.

(e) (1) The ends of all tubes and nipples shall be expanded and flared not less than ⅛ inch over the diameter of the tube hole on all water-tube boilers and headers; or they may be flared not less than ⅛ inch, rolled and beaded; or flared, rolled and seal-welded; or rolled and seal-welded without flaring, provided the throat of the seal weld is not less than 5/16 inch nor more than ⅜ inch and the tubes are reexpanded after welding.

(2) The ends of all tubes and nipples of water-tube boilers and superheaters when not seal-welded shall project through the tube sheets or headers not less than ¼ inch nor more than ½ inch before flaring. Where the tubes enter at an angle, the maximum limit of ½ inch shall apply only at the point of least projection.

(3) If tubes and nipples are seal-welded they shall be reexpanded. Stress relieving shall not be used after welding.

(f) (1) Boiler tubes may be arc- or gas-welded to manifolds, headers or drums without being expanded, provided with the requirements of this paragraph. the welds are strength welds complying

(2) Economizer and waterwall tubes not exceeding 2 inches in size may be attached to headers by means of socket-welded joints, provided the depth of the socket is the maximum allowable but in no case less than ⅜ inch and the diameter is not greater than 1/64 inch above that of the tube. The throat dimension of the fillet weld shall be at least 1¼ times the tube wall thickness and the weld shall be deposited with a minimum of two layers. High amperage shall be employed with the electrode to obtain good penetration of the root pass.

(3) Boiler tubes, not exceeding 2 inches in size, may be attached to headers or drums by any of the acceptable types of groove welds as shown in Figure 52.55–5 (f). The welding grooves shall be of such depth and form as to insure full penetration of the weld metal. The

depth of the groove shall be at least 1¼ times the thickness of the tube, but in no case less than ⅛ inch in any direction. The welding procedure shall be submitted to the Commandant for consideration prior to the welding of superheater tubes of alloy material.

(4) Stress relief and radiographic examination of the welds are not required, except that the welds shall be examined by magnetic particle testing or other acceptable method, when alloy steel materials containing chromium are welded.

(5) Other types of welded attachments having strength equivalent to the above will be considered by the Commandant.

§ 52.55–10 Computations.

(a) (1) The maximum allowable pressure and the minimum thickness of seamless and electric-resistance-welded carbon and seamless alloy steel tubes or nipples subject to internal pressure for water-tube boilers, economizers and superheaters shall be computed by the following formulas:

$$P=S\left[\frac{2T-0.027D-2e}{D-2T+0.027D+2e}\right] \quad (1)$$

$$T=\frac{D}{2}\left(\frac{P}{P+S}\right)+0.0135D+e \quad (2)$$

where:

$P$ = maximum allowable pressure, in pounds per square inch. Where the calculated maximum allowable pressure exceeds an even unit of 10 by more than 1, the next higher unit of 10 may be used.

$S$ = Maximum allowable stress, in pounds per square inch, as given in Table 52.05–10 (a), at not less than the mean wall temperature, which in no case shall be taken as less than 700 degrees F. for tubes absorbing heat. The mean wall temperature of generating tubes shall be taken as the corresponding temperature of saturated steam at design conditions plus 50 degrees F. The mean wall temperatures of superheater tubes in each pass of a superheater shall be certified to by the boiler manufacturer. For tubes which do not absorb heat, the mean wall temperature shall be taken as the temperature of the liquid within the drum.

$T$ = thickness of the tube wall, in inches.

$D$ = outside diameter of the tube, in inches.

$e$ = 0.04 over a length at least equal to the length of the seat plus 1 inch, for tubes expanded into tube seats, except:

$e$ = 0 for tubes expanded into tube seats provided the thickness of the tube ends over a length at least equal to the length of the seat plus 1 inch is not less than the following:

0.095 inch for tubes 1¼-inch OD and smaller.

0.105 inch for tubes above 1¼-inch OD and up to 2-inch OD, inclusive.

0.120 inch for tubes above 2-inch OD and up to 3-inch OD, inclusive.

0.135 inch for tubes above 3-inch OD and up to 4-inch OD, inclusive.

0.150 inch for tubes above 4-inch OD and up to 5-inch OD, inclusive.

$e$ = 0 for tubes strength-welded to headers and drums.

TABLE 52.55–10 (a2)—MAXIMUM ALLOWABLE PRESSURES FOR SEAMLESS AND ELECTRIC-RESISTANCE WELDED LOW CARBON STEEL TUBES SUBJECT TO INTERNAL PRESSURE, WHERE EXPANDED INTO DRUMS OR HEADERS [1] [2]

| Outside diameter, in inches | Maximum allowable pressure, in pounds per square inch, nearest BWG number and the thickness of tube wall, in inches | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 17 0.055 | 16 0.065 | 15 0.075 | 14 0.085 | 13 0.095 | 12 0.105 | 11 0.120 | 10 0.135 | 9 0.150 | 8 0.165 | 7 0.180 | 6 0.200 | 5 0.220 | 4 0.240 | 3 0.260 |
| ¾ | 160 | 480 | 820 | 1,180 | 1,570 | | | | | | | | | | |
| 1 | | 270 | 520 | 780 | 1,040 | 1,320 | 1,770 | | | | | | | | |
| 1¼ | | 210 | 420 | 650 | 880 | 1,120 | 1,500 | 1,910 | | | | | | | |
| 1½ | | 160 | 350 | 550 | 750 | [illegible] | 1,300 | 1,650 | | | | | | | |
| 1¾ | | | 230 | 400 | 560 | 730 | 1,000 | 1,280 | 1,570 | 1,870 | | | | | |
| 2 | | | | 290 | 430 | 570 | 800 | 1,030 | 1,260 | 1,510 | 1,770 | | | | |
| 2¼ | | | | 210 | 340 | [illegible] | 650 | 840 | 1,040 | 1,250 | 1,470 | 1,770 | | | |
| 2½ | | | | | 260 | 370 | 530 | 700 | 880 | 1,060 | 1,250 | 1,500 | 1,770 | | |
| 2¾ | | | | | 200 | 300 | 450 | 600 | 750 | 910 | 1,070 | 1,300 | 1,530 | 1,770 | |
| 3 | | | | | 160 | 240 | 370 | 510 | 650 | 790 | [illegible] | 1,130 | 1,340 | 1,550 | 1,770 |
| 3¼ | | | | | | 190 | 320 | 440 | 560 | 690 | [illegible] | 1,000 | 1,180 | 1,370 | 1,570 |
| 3½ | | | | | | | 270 | 380 | 490 | 610 | 730 | 890 | 1,060 | 1,230 | 1,400 |
| 3¾ | | | | | | | 220 | 330 | [illegible] | 540 | [illegible] | [illegible] | 950 | 1,100 | 1,260 |
| 4 | | | | | | | 190 | 280 | 380 | [illegible] | 580 | 720 | 860 | 1,000 | 1,150 |
| 4½ | | | | | | | | 240 | 340 | 430 | 520 | 650 | 780 | 910 | 1,040 |
| | | | | | | | | | 260 | 340 | 420 | 530 | 650 | 760 | 880 |

[1] These values have been calculated by Formula (1) in § 52.55–10 (a) using allowable stress values at 700° F. for Grades T83–A, T192, and T178–A tubing.

[2] Where calculated allowable pressures exceed an even unit of 10 by more than 1, the next higher unit of 10 is given in the table.

[3] The maximum allowable pressures for electric-resistance-welded low carbon steel tubes shall be limited to boiler, waterwall, economizer, and superheater tubes that are fully enclosed within the boiler setting. For electric-resistance-welded tubing outside the boiler casing, the maximum allowable pressures shall not exceed 85 percent of the values listed in the table.

(2) Where tubes are expanded into drums or headers, table 52.55–10(a2) may be used in lieu of formula (1) or (2) for determining the maximum allowable pressure and minimum thickness of seamless or electric-resistance-welded low carbon steel tubes, provided the maximum mean wall temperature does not exceed 700° F.

(3) The thickness of the ends of tubes strength-welded to drums or headers need not be greater than the run of the tube as determined by formula (2), but the thickness of no tube, where expanded into headers or drums, shall be less than that given in table 52.55–10(a3).

TABLE 52.55–10 (a3)—EXPANDED TUBES

| Outside diameter, in inches: | *Minimum thickness of expanded tubes, in inches* |
|---|---|
| ¾ | 0.055 |
| 1, 1⅛, 1¼ | .065 |
| 1½ | .075 |
| 1¾, 2 | .085 |
| 2¼, 2½, 2¾ | .095 |
| 3 | .105 |
| 3¼, 3½, 3¾ | .120 |
| 4 | .135 |
| 4½ | .150 |

(b) (1) The maximum allowable pressure and minimum thickness of seamless or welded boiler tubes less than 6 inches in diameter, and subject to external pressure, shall be computed by the following formulas:

$$P=\frac{14{,}000\,(T-0.065)}{D} \quad (4)$$

$$T=\frac{PD}{14{,}000}+0.065 \quad (5)$$

where:

$P$ = maximum allowable pressure, in pounds per square inch.

$T$ = thickness of tube, in inches.

$D$ = external diameter of tube, in inches.

(2) As a matter of convenience, table 52.55–10 (b) has been computed from the preceding formulas.

TABLE 52.55–10 (b)—MAXIMUM ALLOWABLE PRESSURE AND MINIMUM THICKNESS FOR SEAMLESS OR WELDED BOILER TUBES LESS THAN 6″ IN DIAMETER AND SUBJECT TO EXTERNAL PRESSURE

| Outside diameter of tube in inches | Maximum allowable pressure, in pounds per square inch, nearest B. W. G. number and thickness of tube wall, in inches | | | | | | |
|---|---|---|---|---|---|---|---|
| | 13 0.095 | 12 0.105 | 11 0.120 | 10 0.135 | 9 0.150 | 8 0.165 | 7 0.180 |
| 1 | 420 | 560 | 770 | 980 | | | |
| 1½ | 280 | 380 | 520 | 660 | 800 | 940 | |
| 1¾ | 240 | 320 | 440 | 570 | 680 | 800 | 920 |
| 2 | 210 | 280 | 390 | 490 | 600 | 700 | 810 |
| 2¼ | 190 | 250 | 350 | 430 | 530 | 630 | 720 |
| 2½ | 170 | 230 | 310 | 400 | 480 | 560 | 650 |
| 3 | | 190 | 260 | 330 | 400 | 470 | 540 |
| 3¼ | | 180 | 240 | 310 | 370 | 430 | 500 |
| 3½ | | 160 | 220 | 280 | 340 | 400 | 460 |
| 4 | | | 200 | 250 | 300 | 350 | 410 |
| 4½ | | | 180 | 220 | 270 | 320 | 360 |
| 5 | | | | 200 | 240 | 280 | 330 |
| 5¼ | | | | | 230 | 270 | 300 |
| 5½ | | | | | 220 | 260 | 300 |

§ 52.55–15 Detail requirements.

(a) Seamless or electric-resistance butt-welded tubes shall be used in all construction where the tubes are subject to internal pressure.

(b) Tubes may be lengthened or safe-ended by forge, electric-resistance, arc or gas butt-welding methods. Arc or gas butt welded joints exceeding 2½ inches shall be nondestructively tested as required by § 56.05–5 of this subchapter. Carbon steel tubing material shall be stress-relieved if arc welded, when the diameter exceeds 2½ inches. Alloy steel tubing shall be given a suitable preheat and postheat treatment to produce acceptable welds if deemed necessary by the Commandant.

## Subpart 52.60—Superheaters, Headers, Water Walls, and Economizers

§ 52.60–1 Definitions.

(a) *Superheaters.* Superheaters, within the meaning of this subpart, are appliances for the purpose of increasing the temperature of steam.

(b) *Header.* Header is a hollow forging, pipe, or welded plate of cylindrical, square, or rectangular cross section, serving as a manifold to which tubes are connected.

(c) *Water wall.* Water wall is a series of tubes or elements spaced along or integral with a wall of a furnace to protect the wall and provide additional heating surface.

(d) *Economizer.* Economizer is a feed-water heater usually located in the uptake or casing of a boiler to absorb heat from the waste gases.

§ 52.60–10 Materials.

(a) Headers or fittings used in connection with these appurtenances, shall be constructed of steel plate conforming to the requirements of Subpart 51.04 of this subchapter; seamless steel pipe conforming to the requirements of Subpart 51.34 of this subchapter or of steel forgings conforming to the requirements of Subpart 51.46 of this subchapter.

(b) Carbon steel plate or forgings may be used for header end closures for metal temperatures not exceeding 800° F. For temperatures exceeding 800° F., the header end closures shall be wrought alloy steel material. The materials shall conform to the requirements of Subpart 51.04, 51.22 or 51.46 of this subchapter and limited to the grades of material listed in Table 52.05–10(a) of this subchapter.

(c) Alternate materials may be used in the construction of headers, provided such materials are approved by the Commandant for the particular application.

§ 52.60–15 Computations.

(a) The maximum allowable pressure of cylindrical headers shall be determined by Formula (3) in § 52.05–10.

(b) The maximum allowable pressure and minimum thickness of tubes shall be in accordance with the tables and formulas provided in Subpart 52.55.

§ 52.60–20 Detail requirements.

(a) *Superheater.* (1) The design pressure of a superheater integral with the boiler shall be not less than the highest setting of the drum safety valves, except that the superheater outlet connections may have a pressure rating conforming to § 52.70–10(e).

(2) Superheaters fitted in conjunction with water-tube boilers may be considered as a part of the boiler, provided the pipe between the boiler and superheater and between superheaters is made of seamless steel material having a minimum thickness computed by the formula specified for piping in § 55.07–5 of this subchapter. Fittings used in making such connections shall be of forged or cast steel.

(3) Superheater headers in which it is possible for water to accumulate shall be fitted with adequate means for draining.

(4) Superheaters designed for normal operating temperatures in excess of 850° F., at the superheater outlet shall be fitted with controls to insure that the maximum temperature does not rise more than 15° above the design conditions. Visual or audible alarms shall be provided.

(5) Arrangement shall be made for venting the superheater in order to permit steam circulation through the superheater when starting the boiler.

(b) *Economizer.* The design pressure of an economizer integral with the boiler and connected to the boiler drum without intervening stop valves shall be at least equal to 110 percent of the highest setting of the safety valves on the drum.

(c) *Headers.* Headers fabricated by means of arc or gas welding shall comply with the requirements of Part 56 of this subchapter for Class I welded pressure vessels.

## Subpart 52.65—Safety Valves

§ 52.65–1 Definitions.

(a) *Safety valve.* Safety valve is a valve designed to open or close automatically to relieve excess pressure in the pressure vessel to which it is attached.

(b) *Spring-loaded safety valve.* Spring-loaded safety valve is a safety valve fitted with a spring which normally holds the valve disk in a closed position against the heat and allows it to open or close at predetermined pressures. Spring-loaded safety valves are characterized by pop action.

(c) *Pressure loaded safety valve.* Pressure loaded pilot actuated safety valve is one which is held in the closed position by steam pressure and controlled in operation by a pilot actuator valve.

(d) *Spring loaded pilot actuated safety valve.* Spring loaded, pilot actuated safety valve is one in which a spring is used in the conventional way to hold the disk against the seat, but which has a piston attached to the spindle and enclosed within a cylinder, which when subjected to a limiting or set pressure, unbalances the spring load thereby opening the valve.

(e) *Spring loaded pilot valve.* Spring loaded pilot valve is a conventional safety valve designed to actuate another spring loaded safety valve through a pressure transmitting line led from the body of the pilot valve.

(f) *Lever safety valve.* Lever safety valve is a safety valve having the disk held on its seat by the action of a weight hung on a lever which is pivoted on a fulcrum.

(g) *Relief valve.* Relief valve is a valve constructed on the general design of safety valves to relieve excess pressure. It may be used for service where an approved safety valve is not required by the regulations of this subchapter. (See § 54.07–5 of this subchapter.)

§ 52.65–5 General requirements.

(a) Each boiler and its superheater shall be provided with one or more approved safety valves designed, constructed and flow-tested in conformance with Subpart 162.001 in Subchapter Q (Specifications) of this chapter. Boilers of more than 500 square feet of water heating surface but without superheaters shall be fitted with at least two safety valves, and boilers with integral superheaters shall have at least two safety valves attached to the drum and one safety valve fitted to the superheater outlet. On river steam vessels whose boilers are connected in batteries without means of shutting off one boiler from another, each battery of boilers shall be treated as a single boiler and equipped with not less than two safety valves of equal size.

(b) Drum safety valves shall be set to relieve at a pressure not in excess of that allowed by the certificate of inspection. Where for any reason this is lower than the pressure for which the boiler was originally designed, an accumulation test, as provided for in paragraph (g) of this section, shall be conducted to insure that the relieving capacity of the safety valve is sufficient for the lower pressure.

(c) The setting of the superheater safety valve shall not exceed the design pressure of the machinery plus the pressure drop in the piping from the superheater outlet to the machinery. To prevent damage to the superheater, the drum safety valves shall be set at a pressure not less than that of the superheater safety valve setting plus 5 pounds minimum plus approximately the normal load pressure drop through the superheater. If there are no intervening valves between the superheater safety valve and boiler, the relieving capacity of the superheater safety valve rated in accordance with the requirements of Subpart 162.001, Subchapter Q (Specifications), may be included in determining the total required relieving capacity of the boiler, provided the drum safety valves have at least 75 percent of the aggregate relieving capacity required. The foregoing requirements do not apply when drum pilot actuated superheater safety valves are used. Installations em-

ploying pilot actuated safety valves will be given special consideration by the Commandant.

(d) In the event the maximum steam generating capacity of the boiler is increased by any means, the relieving capacity of the safety valves shall be checked by an inspector and if determined to be necessary, valves of increased relieving capacity shall be installed.

(e) The total rated relieving capacity of drum and superheater safety valves as certified by the valve manufacturer shall not be less than the maximum generating capacity of the boiler as certified by the boiler manufacturer. The safety valves shall be capable of discharging all the steam that can be generated without allowing the pressure to rise more than 6 percent above the set pressure of the valve.

(f) (1) The boiler manufacturer may certify the normal as well as the maximum generating capacity of the boiler. In the absence of such certification the minimum safety valve relieving capacity shall be determined upon the basis of the pounds of steam generated per hour per square foot of boiler heating surface and the waterwall heating surface, as given in the Table 52.65–5 (f) (1).

TABLE 52.65-5 (f) (1)—MINIMUM RELIEVING CAPACITY

| Type of boiler | Minimum pounds of steam per hour per square foot of surface | | | | | |
|---|---|---|---|---|---|---|
| | Boiler heating surface | | | Water wall surface | | |
| | Hand-fired | Stoker-fired | Oil, or pulverized fuel-fired | Hand-fired | Stoker-fired | Oil, or pulverized fuel-fired |
| Fire-tube | 5 | 7 | 8 | 8 | 10 | 14 |
| Water-tube | 6 | 8 | 10 | 8 | 12 | 16 |

(2) In many cases a greater relieving capacity of safety valves must be provided than required by this paragraph, and in every case the requirements of paragraph (e) of this section shall be met.

(3) The heating surface shall be computed for that side of the boiler surface exposed to the products of combustion exclusive of the superheating surface. In computing the heating surface only the tubes, fireboxes, shells, tube sheets, and the projected area of the headers need be considered. For vertical fire-tube boilers, only that portion of the tube surface up to the middle gauge cock is to be computed. The minimum number and size of safety valves required shall be determined on the basis of the aggregate steaming capacity and the aggregate rated relieving capacity of the valves shall be in accordance with Subpart 162.001 in Subchapter Q (Specifications) of this chapter.

(g) An accumulation test shall be conducted in the presence of an inspector to determine the adequacy of protection provided by the aggregate relieving capacity of the boiler safety valves except in instances where possible damage to superheaters makes this impractical. During this test all steam outlet connections except the safety valves and such others as may be necessary to operate the boiler shall be closed and the fires forced to their maximum capacity for a period of 15 minutes for fire-tube boilers and 7 minutes for water-tube boilers.

(h) On new installations, the safety valve diameter for power boilers, superheaters, or unfired steam generators shall be not less than 1½ inches nor more than 4 inches. Safety valves of 4½ inches diameter may be used for replacements on existing boilers or unfired steam generators. The foregoing diameters apply to the valve inlet.

(i) Lever or weighted safety valves now installed may be continued in use and may be repaired, but when renewals are necessary, lever or weighted safety valves shall not be used. All such replacements shall conform to the requirements of Subpart 162.001 in Subchapter Q (Specifications) of this chapter.

(j) Gags or clamps for holding the safety valve disk on its seat shall be carried on board the vessel at all times.

### § 52.65–15 Installation.

(a) The final setting of boiler safety valves shall be checked and adjusted under steam pressure by an inspector who upon acceptance shall seal the valves. This requirement applies to drum and also superheater safety valves when the latter provide part of the required relieving capacity for the boiler.

(b) Except in the case of superheater valves, safety valves are not to be connected to any fitting with outlets for any purpose other than the escape of steam through the safety valve. They shall be connected directly to the boiler or as close thereto as possible and installed in an upright position with spindles vertical except in the case of especially designed and approved valves.

(c) No shutoff valves shall be placed between the required safety valves and the boiler or unfired steam generator, nor in the escape pipe between the safety valve and atmosphere, nor in the drain pipe from the safety valve.

(d) Twin valves, made by placing individual valves on Y bases, or duplex valves having two valves in the same body, shall be of equal size.

(e) (1) To insure safety valves being free, each safety valve shall have a substantial lifting device by which the valve disk may be positively lifted from its seat when the pressure in the boiler is 75 percent of that at which the valve is set to blow. Such mechanism shall be connected by suitable relieving gear so arranged that the controls may be operated from the fireroom or engineroom floor.

(2) When, due to high pressure, it is impracticable to fit a relieving gear to raise the safety valve from its seat in order to relieve the boiler of pressure, suitable piping and a valve having a relieving capacity of not less than the safety valve(s), may be connected from the boiler to the escape pipe or condenser. The valve shall be arranged to permit operation from the fireroom or engineroom floor.

(f) An independent open drain of a diameter not less than the required tapped drain opening in the valve body shall be run as directly as possible from the body of each boiler safety valve, or the drain from each boiler safety valve may be led to an independent header common only to boiler safety valve drains. The leakoff from drains or drain headers shall be led to suitable locations to avoid hazard to personnel.

## Subpart 52.70—Boiler Mountings and Attachments

### § 52.70–1 Definitions.

(a) *Mountings.* Mountings, within the meaning of the regulations in this subchapter, are nozzle connections, distance pieces, valves, or fittings attached directly to the boiler.

(b) *Main stop valve.* Main stop valve is a valve usually connected directly to the boiler for the purpose of shutting off the steam from the main steam line.

(c) *Auxiliary stop valve.* Auxiliary stop valve is a valve usually connected directly to the boiler for the purpose of shutting off the steam from the auxiliary lines (including the whistle lines).

(d) *Manifold.* Manifold is a fitting with two or more branches having valves either attached by bolting or integral with the fitting.

(e) *Feed valve.* Feed valve is a valve in the feed-water line which controls the boiler feed.

(f) *Blow-off valve.* Blow-off valve is a valve connected directly to the boiler for the purpose of blowing out water, scum, or sediment.

(g) *Dry pipe.* Dry pipe is a perforated or slotted pipe placed in the highest part of the steam space of a boiler to prevent priming.

(h) *Water column.* Water column is a fitting or tube equipped with a water glass attached to a boiler for the purpose of indicating the water level.

(i) *Test cocks.* Test cocks are small cocks on a boiler for indicating the water level.

(j) *Salinometer cocks.* Salinometer cocks are cocks attached to a boiler for the purpose of drawing off a sample of water for salinity tests.

(k) *Fusible plugs.* Fusible plugs are plugs made with a bronze casing and a tin filling which melts at a temperature of 450° to 500° F. They are intended to melt in the event of low water and thus warn the engineer on watch.

### § 52.70–5 Materials and workmanship.

(a) Boiler mountings or attachments shall be made of steel forgings conforming to the requirements of Subpart 51.46 of this subchapter; steel castings conforming to the requirements of Subpart 51.58 of this subchapter; or, where the temperature does not exceed 450° F., they may be made of bronze castings conforming to the requirements of Subpart 51.76 of this subchapter.

(b) For temperatures exceeding 450° F., high strength or alloy steel bolting material complying with the requirements of Subpart 51.49 of this subchapter shall be employed. For temperatures

not exceeding 450° F., commercial carbon-steel bolting conforming to the requirements of Subpart 51.49 of this subchapter may be used.

(c) The use of cast iron for mountings, fittings, valves, or cocks, attached directly to boilers operating at pressures exceeding 30 p. s. i. is prohibited.

**§ 52.70–10 Detail requirements.**

(a) Boiler nozzles, mountings, and attachments having diameters over 1¼ inches shall be fitted with flanged or welded ends. Screwed ends shall not be used for pressures exceeding 600 p. s. i. and shall be limited to ¾-inch pipe size for pressures exceeding 150 p. s. i. Slip-on flanges and socket-welded connections may be used for sizes not exceeding 2 inches in diameter. Butt-welded flanges may be used without diameter limitation.

(b) Where stud bolts are used for the attachment of boiler connections, drilled holes to be tapped for straight threads shall not penetrate within one fourth of the wall thickness from the inside surface of the vessel. The depth of the threads shall be at least equal to 1½ times the diameter of the stud. Studded connections shall meet the requirements for reinforcement. No credit for reinforcement shall be allowed for any areas attached by studs only.

(c) Where pipes are screwed into the plating of the boiler, the minimum number of pipe threads permitted shall be in accordance with the following table:

TABLE 52.70–10 (c)—MINIMUM NUMBER OF PIPE THREADS FOR CONNECTIONS TO BOILER

| | |
|---|---|
| Size of pipe connection, inches | 1 and 1¼ |
| Number of threads per inch | 11½ |
| Minimum number of threads required in opening | 4 |
| Minimum thickness of material required to give above number of threads (inches) | 0.348 |

(d) The nearest steam stop valves and fittings attached to the boiler drum or superheater inlet shall have a pressure rating at least equal to the maximum set pressure of any safety valve on the boiler drum at the corresponding saturated steam temperature.

(e) The nearest steam stop valves and fittings attached to the superheater outlet shall have a pressure rating at least equal to the maximum set pressure of any safety valve on the superheater and at the normal operating superheated steam temperature. Where the superheater safety valve is of the drum pilot actuated type, the pressure rating shall be at least squal to 95 percent of the drum pilot safety valve setting at the normal operating steam temperature of the superheater outlet.

**§ 52.70–25 Feed connections.**

(a) Feed water shall not be discharged into a boiler against surfaces exposed to hot gases, to the radiant heat of the fire or close to a riveted joint.

(b) Feedwater nozzles of boilers with maximum allowable pressures of 400 pounds per square inch, or over, shall be fitted with sleeves or other suitable means employed to reduce the effects of metal temperature differentials.

**§ 52.70–30 Blowoff connections.**

(a) Boilers shall be fitted with a surface and a bottom blowoff valve or cock attached directly to the boiler or to a short distance piece. The surface blowoff valve shall be located within the permissible range of the water level, or fitted with a scum pan or pipe at this level. The bottom blowoff valve shall be attached to the lowest part of the boiler or fitted with an internal pipe leading to the lowest point inside the boiler. Water-tube boilers designed for pressures of 350 pounds per square inch or over are not required to be fitted with a surface blowoff valve. Boilers equipped with a continuous blowdown valve on the steam drum are not required to be fitted with an additional surface blowoff connection.

(b) Where blowoff pipes are exposed to radiant heat of the fire, they shall be protected by fire brick or other suitable heat-resisting material.

**§ 52.70–35 Dry pipes.**

Internal dry pipes may be fitted to stop valves and safety valves, provided such dry pipes have a wall thickness at least equal to standard commercial pipe thickness for their diameter. The area of the opening in such dry pipes shall be at least twice the nominal area of the dry pipe. Openings in dry pipes shall be as near as practicable to the valve and shall be slotted or drilled, the width of the slots to be not less than ¼ inch, or the diameter of the holes to be not less than ⅜ inch. Where dry pipes are used, they shall be provided with drains at each end to prevent an accumulation of water.

**§ 52.70–40 Fusible plugs.**

(a) All boilers, except water-tube boilers, and low-pressure heating boilers operating at pressures not in excess of 30 pounds per square inch, shall be fitted with fusible plugs manufactured from acceptable heats in accordance with Subpart 162.014 of Subchapter Q (Specifications) of this chapter.

(b) Vertical boilers shall be fitted with one fusible plug located in a tube not more than 2 inches below the lowest gauge cock.

(c) Externally fired, cylindrical boilers, with flues, shall have one plug fitted to the shell immediately below the fire line not less than 4 feet from the front end.

(d) Firebox, Scotch, and other types of shell boilers not specifically provided for, having a combustion chamber common to all furnaces, shall have one plug fitted at or near the center of the crown sheet of the combustion chamber.

(e) Double-ended boilers having individual combustion chambers for each end, which combustion chambers are common to all the furnaces in one end of the boiler, shall have one plug fitted at or near the center of the crown sheet of each combustion chamber.

(f) Boilers constructed with a separate combustion chamber for each individual furnace shall be fitted with a fusible plug in the center of the crown sheet of each combustion chamber.

(g) Boilers of types not herein provided for shall be fitted with at least one fusible plug of such dimensions and located in a part of the boiler as will, in the judgment of the inspector, best meet the purposes for which it is intended.

(h) Fusible plugs shall be so fitted that the smaller end of the filling is in direct contact with the radiant heat of the fire, and shall be at least 1 inch higher on the water side than the plate or flue in which they are fitted, and in no case more than 1 inch below the lowest permissible water level as defined in paragraph (i) of this section.

(i) The lowest permissible water level shall be determined as follows:

(1) Vertical fire-tube boilers, one-half of the length of the tubes above the lower tube sheets.

(2) Vertical submerged tube boiler, 1 inch above the upper tube sheet.

(3) Internally-fired fire-tube boilers with combustion chambers integral with the boiler, 2 inches above the highest part of the combustion chamber.

(4) Horizontal-return tubular and dry back Scotch boilers, 2 inches above the top row of tubes.

(5) The lowest permissible water level for all water-tube boilers shall be determined at the time drawings of the boilers are submitted for approval.

(j) (1) Fusible plugs shall be cleaned and will be examined by the marine inspector at each inspection for certification, and oftener, if necessary. If in the marine inspector's opinion the condition of any plug is satisfactory, it may be continued in use.

(2) When fusible plugs are renewed at other than the inspection for certification and no marine inspector is in attendance, the Chief Engineer shall submit a written report to the Officer in Charge, Marine Inspection, who issued the certificate of inspection informing him of the renewal. This letter report shall contain the following information:

(i) Name and official number of vessel.

(ii) Date of renewal of fusible plugs.

(iii) Number and location of fusible plugs renewed in each boiler.

(iv) Manufacturer and heat number of each plug.

(v) Reason for renewal.

(k) Fusible plugs shall not be permitted where the maximum steam temperature to which they are exposed exceeds 425° F.

**§ 52.70–45 Pressure gauges.**

(a) Each boiler shall have a steam gauge connected to the steam space or to the water column or its steam connection. The steam gauge shall be connected to a syphon or equivalent device of sufficient capacity to keep the gauge tube filled with water. Stop valves shall be provided at the connections to the boiler and at the gauge. Gauges shall be located where they can be easily seen.

(b) The gauge connections to the boiler, except the syphon, shall be not less than ¼ inch pipe size, but where ferrous pipe or tubing is used, they shall be not less than ½ inch inside diameter.

(c) The dial of the steam gauge shall be graduated to approximately double the pressure at which the safety valve is set, but in no case less than 1½ times this pressure.

(d) Each double-ended boiler shall be fitted with two steam gauges, one on either end of the boiler.

(e) The error in reading at any point on the gauge shall not exceed 1½ percent of the maximum reading to which the scale is graduated; except that the error in reading at the graduation indicating the steam pressure shall not exceed one-half of 1 percent of the maximum reading to which the scale is graduated.

**§ 52.70–50 Water indicators.**

(a) Each boiler shall have two independent means of indicating the water level in the boiler, one of which shall be a gauge glass. The secondary indicator may consist of a gauge glass, or other device approved by the Commandant, or where the maximum allowable pressure does not exceed 250 pounds per square inch, three test cocks attached directly to the head or shell of the boiler. Where the maximum allowable pressure exceeds 250 pounds per square inch, the gauge glasses shall be of the flat type instead of the common tubular type.

(b) Glass water gauges shall be so located that the lowest visible part of the glass is not lower than the lowest permissible water level, as determined by § 52.70–40 (l). The lowest gauge cock shall be located 2 inches higher than the lowest visible part of the gauge glass, except that for horizontal boilers 48 inches or less in diameter they may be located at the lowest permissible water level.

(c) Double-ended fire-tube boilers shall be equipped as specified in paragraphs (a) and (b) of this section, except that a water-gauge glass, and three water-gauge cocks shall be installed on each end of the boiler.

(d) Externally fired flue boilers, such as are used on central western river vessels, shall be equipped as specified in paragraphs (a) and (b) of this section, except that float gauges may be substituted for gauge glasses.

(e) Gauge glass connections, and pipe connections shall be not less than ½ inch pipe size. Each water-gauge glass shall be fitted with a globe or gate-valved drain piped to a safe discharge point. Water-gauge glasses shall be fitted with top and bottom shutoff valves of such through-flow construction as to prevent stoppage by deposits of sediments. Straight-run globe valves of the ordinary type so designed as to form pockets in which sediment may collect shall not be used on such connections.

(f) When water columns are provided they shall be fitted to the heads or shells of boilers or drums with shutoff valves attached directly to the boiler or drums, or if necessary, connected thereto by a distance piece both at the top and bottom of the water columns. Shutoff valves used in the pipe connections between the boiler and water column or between the boiler and the shutoff valves required by paragraph (e) of this section for gauge glasses, shall be locked or sealed open. Water column piping shall not be fitted inside the uptake, the smoke box, or the casing.

(g) No connections, except for regulators, drain, steam gauges, or appurtenances which do not permit the escape of an appreciable amount of steam or water therefrom, shall be placed on the pipes connecting a water column or gauge glass to a boiler.

**§ 52.70–55 Salinometer cocks.**

In vessels operating in salt water, each boiler shall be equipped with a salinometer cock or valve which shall be fitted directly to the boiler in a convenient position. They shall not be attached to the water gauge or water column.

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# PART 53—LOW-PRESSURE HEATING BOILERS

**Subpart 53.01—General**

Sec.
53.01–1 Scope.

**Subpart 53.03—Steel Plate Heating Boilers**

53.03–1 Scope.
53.03–5 Plan approval.
53.03–10 Materials.
53.03–15 Computations and design.
53.03–20 Braced and stayed surfaces.
53.03–25 Areas to be stayed.
53.03–30 Allowable stresses for stays or braces.
53.03–35 Boiler tubes.
53.03–40 Riveted boilers.
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53.03–50 Boiler openings.
53.03–55 Installation.
53.03–60 Safety valves.
53.03–62 Relief valves.
53.03–63 Installation of safety and relief valves.
53.03–70 Fittings and appliances.
53.03–75 Hydrostatic tests, inspection, and stamping.

**Subpart 53.05—Cast-Iron Heating Boilers**

53.05–1 Scope.
53.05–5 Plan approval.
53.05–10 Installation.
53.05–15 Safety and relief valves.
53.05–20 Fittings and appliances.

AUTHORITY: The provisions of this Part 53 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426 4431, as amended, 4433, as amended, 4434, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404–409, 411, 412, 435, 481, 489, 366, 395, 363, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857.

## Subpart 53.01—General

**§ 53.01–1 Scope.**

(a) The regulations in this part apply to the design and construction of steel plate and cast iron steam and hot water boilers used for heating or hot water supply, the maximum allowable pressure of which shall not exceed the following:

(1) For steel plate boilers—30 pounds per square inch.

(2) For cast iron boilers—15 pounds per square inch for steam boilers and 30 pounds per square inch for hot water boilers.

(b) Except as otherwise provided for in this part, steel plate and cast iron steam and hot water heating boilers designed, fabricated and stamped in conformance with the requirements of the American Society of Mechanical Engineers Rules for Low-Pressure Heating Boilers (A. S. M. E. Boiler and Pressure Vessel Code Section IV) may be accepted for installation on vessels subject to inspection provided the maximum allowable pressure does not exceed 15 pounds per square inch for steam boilers and 30 pounds per square inch for hot water boilers.

(c) The maximum water temperature of hot water boilers shall not exceed 250° F.

(d) When operating conditions exceed those specified in paragraph (a) of this section, steel plate boilers shall be designed and fabricated in accordance with the requirements of Part 52 of this subchapter.

## Subpart 53.03—Steel Plate Heating Boilers

**§ 53.03–1 Scope.**

(a) The regulations in this subpart contain detail requirements for the design and construction of steel plate heating boilers.

(b) A. S. M. E. steel plate heating boilers accepted under the provisions of § 53.01–1 need not comply with the applicable requirements of this subpart except that safety valves, relief valves, fittings and appliances shall meet the requirements prescribed therein.

(c) Steam heating boilers of steel plate construction, the maximum allowable pressure of which exceeds 15 pounds per square inch shall comply in all respects with the requirements of this subpart.

**§ 53.03–5 Plan approval.**

(a) Manufacturers of steel plate heating boilers of riveted or welded construction to be installed on vessels subject to inspection by the Coast Guard shall submit to the Commandant drawings in triplicate fully descriptive of the boilers to be fabricated.

(b) In event of approval of the boiler by the Commandant, it will be assigned a type approval number, which shall be stamped or otherwise permanently attached to each boiler in accordance with the provisions of § 53.03–75.

(c) The manufacturer shall also, upon request, furnish such additional drawings and specifications as may be necessary for the use of each Coast Guard District Commander and Officer in Charge, Marine Inspection. Unless the design or material of the boiler is changed, no further drawings will be required.

(d) A. S. M. E. steel plate heating boilers accepted under the provisions of § 53.01–1 are not subject to type approval by the Commandant and are exempt from the requirements of this section.

### § 53.03–10 Materials.

(a) The material used in the fabrication of steel plate heating boilers shall conform to the requirements of Parts 51 and 52 of this subchapter for power boilers except where otherwise provided for in this subpart.

(b) Plates used for pressure parts of boilers subject to the radiant heat of the fire shall be of firebox quality steel conforming to the requirements of subparts 51.04 or 51.22 of this subchapter.

### § 53.03–15 Computations and design.

(a) The design pressure of boilers covered by this subpart shall not be less than 30 pounds per square inch.

(b) The maximum allowable pressure and the minimum thickness of the cylindrical shell and dished heads of steel plate boilers shall be determined in accordance with the requirements of Subparts 52.05, 52.20 and 52.22 of this subchapter, except that the maximum allowable stress shall not exceed 80 percent of the values given in table 52.05–10 (a) in Part 52 of this subchapter.

(c) The minimum thickness of any boiler plate under pressure shall be ¼ inch for unstayed surfaces and 5/16 inch for stayed surfaces and tube sheets.

### § 53.03–20 Braced and stayed surfaces.

(a) The design pressure, minimum thickness of material, and pitch of stays for stayed surfaces shall be determined in accordance with the requirements of Subpart 52.30 of this subchapter using coefficients as follows:

$C$=170 for plates exposed to the products of combustion and fitted with screw stays with riveted heads or welded collars.

$C$=190 for plates as above but not exposed to the products of combustion.

$C$=238 for plates exposed to the products of combustion fitted with screw stays with single nuts outside of plate and also for stays fitted with washers of twice the diameter of the stay. The thickness of the washers shall not be less than that of the plates through which the stays project and to which they are welded. Stays shall be supported at intervals not exceeding 6 feet.

$C$=274 for plates as above but not exposed to the products of combustion.

(b) The maximum distance from a corner welded joint to the nearest row of stay bolts shall not exceed one-half the maximum allowable pitch as determined by Subpart 52.30 of this subchapter.

(c) The diameter of a screw stay shall be taken at the bottom of the thread or point of least diameter. No screwed stay or stay attached by arc welding, shall be made of stock less than ¾ inch in diameter.

### § 53.03–25 Areas to be stayed.

(a) The area of a segment of a flanged head to be stayed shall be the area enclosed by the lines drawn 2 inches from the tubes and 3 inches from the shell. For unflanged heads the area to be stayed shall be the area enclosed by the shell and a line drawn 2 inches from the tubes.

(b) The staying of unflanged heads of welded boilers is not required if the greatest distance measured along a radial line from the inner surface of the shell to a fully supported line or point does not exceed 1¼ times the maximum allowable pitch of the stays as determined by Subpart 52.30 of this subchapter. For boilers fabricated with the heads set inside of the shell plates so that the distance from the end of the shell to the outside face of the head is at least 3 times the shell thickness, staying is not required if the greatest distance measured as above does not exceed 1½ times the maximum allowable pitch of the stays. For the purposes of applying this paragraph, a fully supported point is a stay rod or tube extending through the head and welded, having sufficient area to meet the requirements of table 53.03–30, and having area of weld in shear at least 1¼ times the required area of the stay member. A fully supported line is the tangent to a row of rolled or welded tubes or welded stays complying with the requirements of Subpart 52.30 of this subchapter or a bent or welded corner joint.

### § 53.03–30 Allowable stresses for stays or braces.

The maximum allowable stresses for stays, staybolts, or braces shall be in accordance with table 53.03–30.

TABLE 53.03–30—MAXIMUM ALLOWABLE STRESSES FOR STAYBOLTS AND STAYS OR BRACES

| Description of staybolts and stays or braces | Stresses (pounds per square inch) | |
|---|---|---|
| | For lengths between supports not exceeding 120 diameters [1] | For lengths between supports exceeding 120 diameters [1] |
| (a) Unwelded or flexible staybolts less than 20 diameters [1] long, screwed through plates with ends riveted over, or such staybolts welded in by the arc welding process | 7,500 | ..... |
| (b) Hollow steel staybolts less than 20 diameters [1] long, screwed through plates with ends riveted over, or such staybolts welded in by the arc welding process | 8,000 | ..... |
| (c) Unwelded stays or braces and unwelded portions of welded stays or braces | 9,500 | 8,500 |

[1] Diameters taken at body of stay or brace.

### § 53.03–35 Boiler tubes.

(a) The minimum thickness of copper tubes for heating boilers shall be determined by the following formula:

$$T=\frac{D}{45}+0.03 \qquad (1)$$

where:

$T$=thickness of tube wall, in inches.

$D$=outside diameter of tube, in inches.

(b) Copper tubes thinner than No. 16 B. W. G. shall not be used.

(c) The minimum thickness of steel or wrought iron tubes for heating boilers shall be in accordance with table 53.03–35 (c).

(d) Tubes may be attached to tube sheets by rolling and beading, or by welding.

(e) Where rolled and beaded tubes are not normal to the tube sheets, the plates shall have sufficient thickness to provide a parallel seating of not less than ¼ inch in depth between planes at right angles with the axis of the tubes.

TABLE 53.03–35 (c)—STEEL OR WROUGHT IRON TUBE FOR HEATING BOILERS

| Diameter (inches) | Minimum thickness of tubes (inch) |
|---|---|
| 1 or over but less than 2½ | 0.095 |
| 2½ or over but less than 3¼ | .105 |
| 3¼ or over but less than 4 | .120 |
| 4 or over but less than 5 | .135 |

### § 53.03–40 Riveted boilers.

Riveted joints of heating boilers shall conform to the requirements of Subpart 52.10 of this subchapter as specified for power boilers.

### § 53.03–45 Welded boilers.

(a) The design and construction of welded heating boilers shall conform to the applicable requirements prescribed in Part 56 of this subchapter for power boilers, except as specified in this subpart.

(b) Radiographic examination and stress relieving of welded joints are not required.

(c) Welded longitudinal shell joints shall be of the double welded butt type or of the single welded butt type fitted with a backing strip.

(d) The circumferential welded shell joints may be of the single or double welded butt type.

(e) Unstayed dished heads, either concave or convex to the pressure, with or without flanges, may be used, provided the diameter of the heads does not exceed 42 inches and the radius of the dish does not exceed 75 inches. For diameters exceeding 42 inches, dished heads shall have flanges not less than 1 inch in length, and shall meet the requirements for power boilers.

(f) Where stays or tubes are welded to plates which require staying, the attachment shall meet the following requirements:

(1) The stays shall be inserted into holes through the tube sheets and attached thereto by strength fillet welds. The size of the fillet weld attaching the stay to the plate shall be not less than the thickness of the plate being stayed, except for plates thicker than ⅜ inch, in which case the size of the fillet weld shall be ⅜ inch. The holes in the plate shall be countersunk or beveled by machining or pressing, or the stays may protrude through the plates or a combination of these methods may be used. The area of the weld, in shear, measured parallel to that portion of the stay in or extending through the plate shall be not less than 1¼ times the required cross-sectional area of the stay.

(2) The ends of stays inserted through plates shall not project more than ⅜ inch beyond surfaces exposed to the products of combustion.

(3) The welding shall be done in such manner that excessive weld deposits do not project beyond the surface of the plate at the root of the weld.

(g) Welded joints attaching unflanged heads, tube sheets, sides, or combustion chamber plates shall be of the single or double welded butt type where possible. Other acceptable types of attachments are the square tee double fillet welded joint and single or double bevel grooved joints.

(h) Unflanged plates of welded joints shall be beveled not less than 45° to permit complete penetration of the weld metal and shall have a fillet reinforcement whose throat dimension shall not be less than one and one-fourth times the thickness of the shell or head, whichever is the least.

**§ 53.03–50 Boiler openings.**

(a) Boilers shall be provided with suitable manhole or handhole openings or washout plug openings to permit internal inspection and removal of sediment. Where the size of the boiler is such that entrance is impractical manhole openings may be omitted.

(b) A manhole shall be placed in the front head below the tubes of a horizontal return tubular boiler 48 inches or over in diameter. There shall be a manhole in the upper part of shell or head of a fire-tube boiler over 48 inches in diameter, except a vertical fire-tube boiler, or a boiler used exclusively for hot-water heating where there is no steam space.

(c) Vertical fire-tube or similar type boilers shall have at least 3 handholes or washout plugs in the lower part of the water leg and at least 2 handholes or washout plugs near the line of the lower tube sheet.

(d) A fire door or other access opening not less than 11 by 15 inches or 10 by 16 inches or 15 inches in diameter shall be provided for the furnace of an internally fired boiler in which the least furnace dimension is 28 inches or over.

(e) Washout plugs shall be made of nonferrous material and be of not less than 2 inches pipe size.

(f) Washout openings may be used for return pipe connections and the washout plug placed in a tee so that the plug is directly opposite and as close as possible to the opening in the boiler.

(g) All threaded openings shall be tapped into material having a minimum thickness as specified for the various pipe sizes in table 53.03–50 (g).

TABLE 53.03–50 (g)—MINIMUM THICKNESS OF MATERIAL FOR THREADED CONNECTIONS

| Pipe size (inches) | Minimum thickness of material or length of thread required (inch) |
|---|---|
| 1 and under | ¼ |
| 1¼ to 2, inclusive | 11/32 |
| 2½ | 13/32 |
| 3 to 3½, inclusive | ⅜ |

(h) Flanged pipe connections to boilers shall conform to the standards given in table 55.07–15 (e1) of Part 55 of this subchapter for the corresponding pipe sizes.

**§ 53.03–55 Installation.**

(a) Feed or makeup water shall not be discharged directly into any part of a boiler exposed to the radiant heat of the fire. Feed water shall not be introduced through the openings or connections used for the water column, the water gauge, or the gauge cocks.

(b) Hot water systems shall be so installed that there will be no opportunity for the fluid-relief column to be accidentally shut off.

(c) When a stop valve is used in the supply pipe connection of a single boiler, there shall be one used in the return pipe connection.

(d) A stop valve shall be used in each supply and return pipe connection if more than one boiler is connected to a common system.

(e) Provision shall be made for cleaning the interior of the return piping at or close to the boiler.

(f) When stop valves are used they shall be properly designated on tags of metal or other durable material as indicated by the following:

> Supply valve—Number ( ). Do not close without also closing return valve—Number ( ).

> Return valve—Number ( ). Do not close without also closing supply valve—Number ( ).

**§ 53.03–60 Safety valves.**

(a) Each steam heating boiler shall have one or more approved safety valves set to discharge at a pressure of not to exceed 30 p. s. i., and designed, constructed and flow-tested for actual capacity in conformance with Subpart 162.012 of Subchapter Q (Specifications) of this chapter.

(b) The minimum safety valve capacity in pounds per hour shall be determined by dividing the maximum B. t. u. output at the boiler nozzle obtained by the firing of any fuel, for which the unit is designed, by 1,000 or by multiplying the square feet of heating surface by 5. In many cases a greater relieving capacity of valves will have to be provided than the minimum specified by these regulations. In all cases the requirements of paragraph (c) of this section shall be met.

(c) The steam safety valve capacity for each boiler shall be such that with the fuel-burning equipment installed, the pressure cannot rise more than 6 percent above the maximum allowable pressure of the boiler. For set pressures not exceeding 15 p. s. i., the safety valve capacity may be such that with the fuel-burning equipment installed, the pressure cannot rise more than 5 pounds above the maximum allowable pressure.

(d) When operating conditions are changed, or additional boiler heating surface is installed, the safety valve capacity shall be increased, if necessary, to meet the new conditions and be in accordance with paragraph (c) of this section. The additional safety valves may be installed on the outlet piping provided there is no intervening valve.

**§ 53.03–62 Relief valves.**

(a) Each hot-water heating or hot-water supply boiler shall have one or more approved relief valves set to relieve at a pressure not to exceed 30 p. s. i., and designed, constructed and flow-tested for actual capacity in conformance with Subpart 162.013 of Subchapter Q (Specifications) of this chapter.

(b) The steam relieving capacity in pounds per hour shall be determined by dividing the maximum B. t. u. output at the boiler nozzle obtained by the firing of any fuel, for which the unit is designed, by 1,000 or by multiplying the square feet of heating surface by 5. In many cases a greater relieving capacity of valves will have to be provided than that minimum specified by the regulations in this subpart. In every case, the requirements of paragraph (c) of this section shall be met.

(c) The relief valve capacity for each boiler shall be such that with any fuel burning equipment installed the pressure cannot rise more than 3 pounds per square inch above the maximum allowable pressure of the boiler.

**§ 53.03–63 Installation of safety and relief valves.**

(a) Safety and relief valves shall be installed with the spindle vertical, if possible, and may be connected directly to the boiler, or to a fitting connected to the boiler by a close nipple, or to a Y base or valveless steam or water pipe between adjacent boilers, or to a valveless header connecting steam or water outlets in the same boiler. Safety and relief valves shall not be connected to an internal pipe in the boiler.

(b) When a Y base is used the inlet area shall be not less than the combined outlet areas.

(c) When the size of the boiler requires a safety or relief valve larger than 4 inches in diameter, two or more valves having the required combined capacity shall be used. When two or more valves are used on a boiler, they may be single, directly attached, or mounted on a Y base.

(d) No shutoff of any description shall be placed between the safety or relief valve and the boiler, nor on discharge pipes between such valves and the atmosphere.

(e) The escape from safety or relief valves shall be fitted with discharge piping so arranged that there is no danger of scalding operating personnel.

(f) The area of the discharge pipe shall be not less than the area of the valve or aggregate area based on the nominal diameters of the valves with which it connects. The discharge pipe shall be fitted with an open drain to prevent water from lodging in the upper

part of the valve or in the pipe. When an elbow is placed on a safety- or relief-valve discharge pipe, it shall be located close to the valve outlet.

**§ 53.03–70 Fittings and appliances.**

(a) *Steam gauges.* (1) Each steam boiler shall have a steam gauge connected to its steam space, or to its water column, or to its steam connection by means of a siphon or equivalent device exterior to the boiler and of sufficient capacity to keep the gauge tube filled with water and so arranged that the gauge cannot be shut off from the boiler except by a cock, with T or lever handle, placed in the pipe near the gauge. The handle of the cock shall be parallel to the pipe on which it is located when the cock is open.

(2) Connections to steam gauge siphon shall be of nonferrous metal when smaller than 1 inch pipe and longer than 5 feet between the siphon and point of connection of pipe to boiler, and also when smaller than ½ inch pipe size and shorter than 5 feet between the siphon and point of connection of pipe to boiler.

(3) The scale on the dial of the gauge shall be graduated to not less than 30 p. s. i. The gauge shall be provided with effective stops for indicating pointer at the zero point. The travel of the pointer from zero to 30 p. s. i. shall be at least 3 inches.

(b) *Water pressure gauges.* (1) Each hot water boiler shall have a pressure gauge connected to it or to its flow connection in such a manner, that it cannot be shut off from the boiler except by a cock, with T or lever handle, placed on the pipe near the gauge. The handle of the cock shall be parallel to the pipe on which it is located when the cock is open.

(2) Pressure gauge connections shall be of nonferrous material when smaller than 1 inch pipe size and longer than 5 feet between gauge and point of connection of pipe to boiler, and also when smaller than ½ inch pipe size and shorter than 5 feet between gauge and point of connection of pipe to boiler.

(c) *Thermometers.* (1) Each hot-water boiler shall have a thermometer so located and connected that the temperature may be read at the same time as the water pressure is being observed.

(2) The thermometer shall be so located that it shall at all times indicate the temperature in degrees Fahrenheit of the water in the boiler or near the outlet.

(d) *Temperature combustion regulator.* A temperature combustion regulator, which will control the rate of combustion to prevent the temperature of the water from rising above 250° F. at or near the outlet, or a thermostatic device which will relieve the pressure on the boiler when the temperature exceeds 250° F. shall be installed on each hot water heating boiler.

(e) *Pressure control regulator.* When a pressure control regulator is used, it shall operate and prevent the steam pressure from rising above 30 p. s. i.

(f) *Bottom blowoff.* Each boiler shall have a blowoff pipe connection fitted with a valve or cock of not less than ¾ inch pipe size connected to the lowest water space available.

(g) *Water gauge glasses.* Each steam boiler shall have one or more water gauge glasses attached to the water column or boiler by means of valved fittings with the lower fitting provided with a valve or pet cock.

(h) *Gauge cocks.* Each steam boiler shall have two or more gauge cocks located within the visible range of the water glass.

(i) *Water column pipes.* The minimum size of pipes connecting a water column to a steam boiler shall be 1 inch. No connections, except for regulator, drain or steam gauge, shall be attached to a water column or the piping connecting a water column to a boiler. If the water column or gauge glass is connected to the boiler by pipe and fittings, a T, or equivalent fitting, in which a drain valve and piping may be attached, shall be installed in the water piping connection at every right angle turn to facilitate cleaning.

(j) *Automatic low-water fuel cutoff.* (1) Each automatically-fired steam boiler shall be equipped with an automatic low-water fuel cutoff, so located as to automatically cut off the fuel supply when the surface of the water falls below the lowest safe water level. If a water-feeding device is installed in conjunction with the required low-water fuel cutoff, it shall be so constructed that the water inlet valve cannot feed water into the boiler through the float chamber and so located as to supply the required amount of feed-water when the surface of the water falls to the lowest safe water level. This point shall be not lower than the lowest visible part of the water glass.

(2) The fuel or feed-water control device may be attached direct to the boiler or to the tapped openings provided for attaching a water glass direct to a boiler, provided that such connections from the boiler are non-ferrous T's or Y's not less than ½-inch pipe size between the boiler and the water glass, so that the water glass is attached direct and as close as possible to the boiler. The straightway tapping of the Y or T shall take the water glass fitting, and the side outlet of the Y or T shall take the fuel cutoff or water-feeding device.

(3) Low water cutoff devices employing a float and float bowl shall have a vertical straightaway valved drain pipe at the lowest point in the water equalizing pipe connection by which the bowl and equalizing pipe can be flushed and the device tested.

**§ 53.03–75 Hydrostatic tests, inspection, and stamping.**

(a) Each boiler shall be subjected to a hydrostatic test pressure of not less than 60 pounds per square inch by the manufacturer.

(b) Shop inspection of A. S. M. E. approved heating boilers by a Coast Guard inspector is not required.

(c) Except as provided for in paragraph (b) of this section, heating boilers of steel plate construction, the maximum allowable pressure of which exceeds 15 p. s. i., shall be examined in the manufacturer's shop by an inspector while the boiler is subjected to the required hydrostatic test pressure. The inspector shall ascertain that there are no defects in workmanship and materials and that no defects have occurred due to the hydrostatic test.

(d) Steel plate heating boilers of the automatically controlled package type shall be subjected to such operating tests as may be prescribed by the Commandant.

(e) Upon completion of the hydrostatic test and inspection of heating boilers subject to shop inspection, and after such boilers are found acceptable, they shall be stamped in a suitable location so as to be readily visible, with the following data:

---
(Name of fabricator and serial number)
---
(Month and year fabricated)
---- P. s. i.
(Maximum allowable pressure) (Steam)
---- Pounds per hour
(Safety valve capacity, minimum)
Coast Guard approval No. and symbol ------
Inspector's initials ----------

(f) After installation, each heating boiler shall be hydrostatically tested to twice the pressure at which the safety or relief valve is set to open.

## Subpart 53.05—Cast-Iron Heating Boilers

**§ 53.05–1 Scope.**

(a) The regulations in this subpart contain requirements for the design and construction of cast iron heating boilers.

(b) A. S. M. E. cast iron heating boilers accepted under the provisions of § 53.01–1 shall comply with the applicable requirements for safety valves, relief valves, fittings and appliances prescribed in this part.

**§ 53.05–5 Plan approval.**

A.S.M.E. cast iron heating boilers accepted under the provisions of § 53.01–1 are not subject to type approval by the Commandant and are exempt from the requirements of this section.

**§ 53.05–10 Installation.**

The provisions of § 53.03–55 shall apply to cast iron boilers.

**§ 53.05–15 Safety and relief valves.**

(a) The provisions of §§ 53.03–60, 53.03–62 and 53.03–63 shall apply to cast iron heating boilers except as specified in this section.

(b) Safety valves shall be set to discharge at a pressure not to exceed 15 pounds per square inch and relief valves shall be set to discharge at a pressure not to exceed 30 pounds per square inch.

(c) Safety and relief valves for cast iron heating boilers shall be such that with any fuel burning equipment installed, the pressure cannot rise above the maximum allowable pressure more than 5 pounds per square inch for a steam boiler and three pounds per square inch for a hot water boiler.

**§ 53.05–20 Fittings and appliances.**

The provisions of § 53.03–70 shall apply to fittings and appliances for cast iron boilers, except that the pressure control regulator shall operate to prevent the steam pressure from rising above 15 pounds per square inch.

## PART 54—UNFIRED PRESSURE VESSELS

### Subpart 54.01—General Requirements

Sec.

54.01–1 Scope.
54.01–5 Definitions.
54.01–10 Plan approval.

### Subpart 54.03—Design and Construction

54.03–1 Materials.
54.03–5 Workmanship and design.
54.03–10 Cylindrical shells and heads.
54.03–12 Cast-iron heads.
54.03–15 Tube sheets.
54.03–20 Heat exchanger tubes.
54.03–25 Bolted flanged connections.
54.03–27 Unfired steam boilers.
54.03–30 Evaporators.
54.03–35 Access and inspection openings.
54.03–40 Openings and reinforcements.

### Subpart 54.07—Pressure-Relief Devices

54.07–1 General requirements.
54.07–5 Relief valves.
54.07–10 Safety valves.
54.07–15 Heat exchanger relief valves.
54.07–20 Rupture disks.
54.07–25 Safety relief valves.

AUTHORITY: The provisions of this Part 54 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426–4431, as amended, 4433, as amended, 4434, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404–409, 411, 412, 435, 481, 489, 366, 395, 363, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965, Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857, unless otherwise noted.

### Subpart 54.01—General Requirements

**§ 54.01–1 Scope.**

(a) The regulations in this part contain detail requirements for the design and construction of unfired pressure vessels subject to inspection by the Coast Guard.

(b) The following classes of unfired pressure vessels are not subject to plan approval or shop inspection by the Coast Guard and are exempt from the requirements of this part:

(1) All unfired pressure vessels designed for a maximum allowable pressure not exceeding 15 pounds per square inch.

(2) Compression tanks containing water under pressures not exceeding 100 pounds per square inch and temperatures not exceeding 200 degrees F. Compression tanks containing water and fitted with a permanent air charging line subject to pressures not exceeding 15 pounds per square inch and temperatures not exceeding 200 degrees F.

(3) Condensers, jacket water coolers and lubricating oil coolers containing mediums at or below the pressures and temperatures specified in Table 54.01–1 (c).

(c) Unfired pressure vessels,[1] exclusive of those covered by paragraph (b) of this section, designed for a maximum allowable pressure exceeding 15 pounds per square inch shall comply with the requirements for materials, construction, welding, inspection and marking as specified in this subchapter, except such vessels may be exempt from shop inspection under any of the following conditions:

(1) When the internal volume does not exceed 5 cubic feet and the maximum allowable pressure does not exceed 100 p. s. i.

(2) When a pressure vessel contains mediums at or below pressures and temperatures specified in Table 54.01–1 (c).

TABLE 54.01-1 (c)—EXEMPTION OF UNFIRED PRESSURE VESSELS FROM SHOP INSPECTION

| Service | Pressure—p. s. i. | Temperature, °F. |
|---|---|---|
| Steam, gas or vapors | 15 | |
| Fuel oil | 100 | 150 |
| Lubricating oil | 100 | 300 |
| Liquids, except fuel oil and lubricating oil. | 100 | 300 |

(d) Unfired pressure vessels containing dangerous articles, substances or combustible liquids which are required by law or regulation to be carried in containers fabricated as a pressure vessel shall comply with the requirements for materials, construction, welding, inspection and marking as specified in this chapter, irrespective of pressure, temperature or capacity, except vessels containing such dangerous articles which are permitted by Subchapter N (Dangerous Cargoes) of this chapter, to be carried in containers constructed in accordance with the requirements of the Interstate Commerce Commission.

(e) Small unfired pressure vessels which do not fully comply with the requirements of this subchapter may be accepted by the Commandant for installation on vessels subject to inspection by the U. S. Coast Guard, provided:

(1) The failure of such unfired pressure vessels will not endanger the safety of the vessel.

(2) The internal volume does not exceed 5 cubic feet.

(3) The construction complies with the requirements of a recognized code, or tests as prescribed by the Commandant are carried out to prove that the design and fabrication are suitable for the intended application.

(4) Such unfired pressure vessels shall otherwise comply with the requirements for plan approval and marking as specified in this subchapter.

(f) Unfired pressure vessels, other than those containing compressed air, which do not fully comply with the requirements of this subchapter may be accepted for installation on vessels subject to inspection, provided:

(1) They are used exclusively in the handling and storage of petroleum and associated products obtained in offshore drilling operations.

(2) The design, fabrication, and stamping comply with the requirements of the API-ASME or ASME Code for Unfired Pressure Vessels.

**§ 54.01–5 Definitions.**

(a) *Unfired pressure vessel.* An unfired pressure vessel is a tank containing gas, vapor, or liquid, or a combination thereof, under pressure, and not exposed to the products of combustion.

(b) *Heat exchanger.* A heat exchanger is a device usually consisting of a shell and tubes or coils by which heat is transferred from one substance to another.

**§ 54.01–10 Plan approval.**

Manufacturers intending to fabricate unfired pressure vessels, heat exchangers, evaporators and similar appurtenances covered by the regulations in this part, to be installed on vessels subject to inspection by the Coast Guard, shall submit to the Officer in Charge, Marine Inspection, having jurisdiction over the vessel, detail plans in triplicate, which shall be fully descriptive of the pressure parts of such unfired pressure vessels. When due to location of the fabrication shop, such procedure would result in unnecessary delay in transmission, the plans may be forwarded directly to the Commandant (MMT) U. S. Coast Guard, Washington, D.C., 20226.

[1] The shell, tubes or coils of a heat exchanger shall be considered an unfired pressure vessel if such parts may be subjected to steam, gas or vapor pressures exceeding 15 pounds per square inch.

## Subpart 54.03—Design and Construction

**§ 54.03–1 Materials.**

(a) Unfired pressure vessels and appurtenances covered by this part may be fabricated of material conforming to the specifications given in Part 51 of this subchapter and limited to the grades of material listed in table 52.05–10(a) in Part 52 of this subchapter and table 54.03–10(c) except as otherwise provided for in this part.

(b) Steel plate used for pressure parts of unfired pressure vessels may be of Class B material complying with the requirements of Subpart 51.04, 51.22 or 51.23 in Part 51 of this subchapter, except that in the case of unfired pressure vessels having maximum allowable pressures exceeding 700 pounds per square inch or temperatures exceeding 650° F. steel plate shall be of Class A material meeting the requirements of Subpart 51.04 in Part 51 of this subchapter.

(c)(1) Arc- or gas-welded pressure vessels over one inch in thickness, when constructed of steel plate complying with Subpart 51.04 of this subchapter conforming to specifications A202, A203, A204, A212, A225, A299, A302, and A387, Grade A, B, or C, shall conform to the requirements for Class I welded pressure vessels.

(2) Where vessels are constructed of steel plate, conforming to specifications A202, A203, A204, A212, A225, A299, A302, and A387, Grade A, B, or C, which do not exceed one inch in thickness, the requirements for Class II welded pressure vessels shall apply and the vessels shall be stress-relieved as required by § 56.01–70(h) of this subchapter.

(3) Arc- or gas-welded pressure vessels, when constructed of steel plate conforming to specifications A357, A387, Grades D and E, and A410, shall conform to the requirements for Class I pressure vessels.

(d) Carbon- and alloy-steel castings shall comply with the grades of material listed in table 52.05–10 (a) in Part 52 of this subchapter. The casting quality factor specified in § 52.05–13 of this subchapter shall be applied to the stresses given in table 52.05–10 (a).

(e) For electric resistance-welded pipe or tubing the stress values in table 52.05–10 (a) in Part 52 of this subchapter shall be substituted in the applicable design formulas for the factor SE.

(f) Unfired pressure vessels may be constructed of cast iron conforming to the applicable specifications of Part 51 of this subchapter under the following conditions:

(1) Cast iron shall not be used in the construction of shells and heads of pressure vessels where subject to steam pressures exceeding 30 pounds per square inch or where subject to gas or liquid pressures exceeding 125 pounds per square inch.

(2) The maximum allowable stress for cast iron as given in table 54.03–1 (f) shall be used in the applicable formula for unfired pressure vessels.

TABLE 54.03–1(f)—MAXIMUM ALLOWABLE STRESS FOR CAST IRON

| Minimum tensile strength, p. s. i.: | *Maximum tensile stress, p. s. i.* |
|---|---|
| 20,000 | 2,000 |
| 25,000 | 2,500 |
| 30,000 | 3,000 |
| 35,000 | 3,500 |
| 40,000 | 4,000 |
| 50,000 | 5,000 |

(g) Nonferrous materials may be used in the construction of unfired pressure vessels subject to the following conditions:

(1) The grade of materials shall be as specified in Part 51 of this subchapter, and as given in Table 54.03–10(c).

(2) The pressure and temperature limitations for bronze castings shall be as given in § 55.07–1(d) of this subchapter.

(3) Welding may be employed for aluminum alloy grades 6061–T6 and 6063–T6, provided welding procedure qualification tests are conducted in accordance with § 56.01–15 of this subchapter.

**§ 54.03–5 Workmanship and design.**

(a) Equipment covered by this part and constructed of plates with riveted or welded joints shall conform to all the requirements of Part 52 of this subchapter for such construction, except as provided otherwise in this part.

(b) Flanges cast integral with shells or heads shall have a fillet radius not less than the thickness of the necks to which they are attached.

(c) The corner radius of a cast unstayed dished head measured on the concave side of the head shall be not less than three times the thickness of the head, but in no case less than 6 percent of the outside diameter of the shell.

**§ 54.03–10 Cylindrical shells and heads.**

(a) The maximum allowable pressure of cylindrical shells and heads of unfired pressure vessels under internal pressure shall be determined by the applicable formulas given in Part 52 of this subchapter, except as provided otherwise in this part. The maximum allowable pressure of cylindrical shells shall be determined from Formula (1) of § 52.05–10 of this subchapter when the thickness does not exceed one-half of the inside radius, or the maximum allowable pressure does not exceed 0.385 SE. When the thickness of the shell exceeds one-half of the inside radius or when the maximum allowable pressure exceeds 0.385 SE, Formula (2) of § 52.05–10 of this subchapter shall be used.

(b) The minimum thickness of shell plates, heads or dome plates of seamless or welded construction shall be $\frac{3}{32}$ inch after forming and without allowances for corrosion. The minimum thickness, after forming, of any plate in a riveted pressure vessel shall be $\frac{3}{16}$ inch without corrosion allowance.

(c) The maximum allowable stresses for nonferrous materials shall be as given in table 54.03–10(c).

TABLE 54.03–10(c)—MAXIMUM ALLOWABLE STRESSES [1] FOR NONFERROUS MATERIALS

| Specification | A.S.T.M. designation | Grade | | Minimum tensile strength p.s.i. | Minimum yield strength p.s.i. | Notes | For metal temperatures not exceeding ° F. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A.S.T.M. | C.G. | | | | 100 | 150 | 200 | 250 | 300 | 350 | 400 [2] | 450 | 500 | 550 | 600 | 650/700 |
| *Aluminum-alloy plates and sheets* | | | | | | | | | | | | | | | | | | |
| 51.79 | B–209 | 1060 | 1060–0 | 9,500 | 2,500 | (3) | 1,650 | 1,650 | 1,600 | 1,450 | 1,250 | 1,200 | 1,050 | | | | | |
| 51.79 | B–209 | 1100 | 1100–0 | 11,000 | 3,500 | (3) | 2,350 | 2,350 | 2,300 | 2,100 | 1,850 | 1,600 | 1,300 | | | | | |
| 51.79 | B–209 | 3003 | 3003–0 | 14,000 | 5,000 | (3) | 3,350 | 3,150 | 2,900 | 2,700 | 2,400 | 2,100 | 1,800 | | | | | |
| 51.79 | B–209 | 3004 | 3004–0 | 22,000 | 8,500 | (3) | 5,500 | 5,500 | 5,500 | 5,200 | 4,500 | 3,600 | 2,950 | | | | | |
| 51.79 | B–209 | 5050 | 5050–0 | 18,000 | 6,000 | (3) | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 | 3,350 | 2,100 | | | | | |
| 51.79 | B–209 | 5052 | 5052–0 | 25,000 | 9,500 | (3) | 6,250 | 6,250 | 6,200 | 6,000 | 5,400 | 4,650 | 3,500 | | | | | |
| 51.79 | B–209 | 5083 | 5083–0 | 40,000 | 18,000 | (4) | 10,000 | 10,000 | | | | | | | | | | |
| 51.79 | B–209 | 5086 | 5086–0 | 35,000 | 14,000 | | 8,700 | 8,700 | | | | | | | | | | |
| 51.79 | B–209 | 5154 | 5154–0 | 30,000 | 11,000 | (3) | 7,350 | 7,350 | 7,350 | 7,000 | 6,400 | | | | | | | |
| 51.79 | B–209 | 5456 | 5456–0 | 42,000 | 19,000 | | 10,500 | 10,400 | | | | | | | | | | |
| 51.79 | B–209 | 6061–T6W | 6061–T6W | [5] 24,000 | | | 6,000 | 5,900 | 5,700 | 5,400 | 5,000 | 4,200 | 3,200 | | | | | |

See footnotes at end of table.

TABLE 54.03-10(c)—MAXIMUM ALLOWABLE STRESSES [1] FOR NONFERROUS MATERIALS—Continued

| Specification | A.S.T.M. designation | Grade | | Minimum tensile strength p.s.i. | Minimum yield strength p.s.i. | Notes | For metal temperatures not exceeding ° F. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A.S.T.M. | C.G. | | | | 100 | 150 | 200 | 250 | 300 | 350 | 400 [2] | 450 | 500 | 550 | 600 | 650/700 |
| *Copper and copper-alloy plates* | | | | | | | | | | | | | | | | | | |
| 51.67 | B-11 | Copper | B11-1, -2, -3, -4. | 30,000 | 10,000 | (4) | 6,700 | 6,700 | 6,500 | 6,300 | 5,000 | 3,800 | 2,500 | | | | | |
| 51.67 | B-96 | Copper-silicon | B96-A or -C | 50,000 | 18,000 | (6) | 12,000 | 12,000 | 11,900 | 11,700 | | | | | | | | |
| 51.67 | B-171 | Naval brass | B171-A | 50,000 | 20,000 | (7) | 12,500 | 12,500 | 12,000 | 11,200 | 10,500 | 7,500 | 2,000 | | | | | |
| 51.67 | B-171 | Admiralty metal. | B171-B | 45,000 | 15,000 | (7) | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 8,000 | 5,000 | 3,000 | | | | |
| 51.67 | B-171 | Copper nickel 70-30. | B171-C | 50,000 | 20,000 | (7 9) | 12,500 | 12,200 | 11,900 | 11,600 | 11,300 | 11,000 | 10,800 | 10,600 | 10,400 | 10,200 | 10,000 | 9,800/9,700 |
| 51.67 | B-171 | Copper nickel 90-10. | B171-D | 40,000 | 15,000 | (7 9) | 10,000 | 10,000 | 9,800 | 9,500 | 9,300 | 9,000 | 8,700 | 8,300 | 8,000 | 7,000 | 6,000 | |
| 51.67 | B-402 | Copper nickel 70-30. | B-402-A | 45,000 | 18,000 | | 11,200 | 10,800 | 10,500 | 10,200 | 9,900 | 9,700 | 9,500 | 9,400 | 9,300 | 9,200 | 9,100 | 9,000/8,900 |
| 51.67 | B-402 | Copper nickel 90-10. | B-402-B | 38,000 | 15,000 | | 9,500 | 9,500 | 9,300 | 9,000 | 8,800 | 8,500 | 8,200 | 7,900 | 7,600 | 6,600 | 5,700 | |
| 51.67 | B-169 | Aluminum bronze alloy D. | B169-D | 70,000 | 30,000 | (7) | 17,500 | 17,500 | 16,800 | 16,000 | 15,500 | 15,000 | 14,500 | 12,000 | 10,000 | | | |
| 51.67 | B-171 | Aluminum bronze alloy D. | B171-E | 70,000 | 30,000 | (4 7) | 17,500 | 17,500 | 16,800 | 16,000 | 15,500 | 15,000 | 14,500 | 12,000 | 10,000 | | | |
| 51.67 | B-171 | Aluminum bronze alloy E. | B171-E, -F | 90,000 | 36,000 | (4 7) | 22,500 | 22,500 | 21,000 | 19,500 | 18,000 | 16,500 | 15,000 | 13,500 | 12,000 | 10,500 | 9,000 | 7,500/6,000 |
| *Seamless pipe or tubes* | | | | | | | | | | | | | | | | | | |
| 51.80 | B-210 | 1060 | 1060-0 | 9,500 | 2,500 | (3 9) | 1,650 | 1,650 | 1,600 | 1,450 | 1,250 | 1,200 | 1,050 | | | | | |
| 51.80 | B-235 | | | | | | | | | | | | | | | | | |
| 51.80 | B-210 | 3003 | 3003-0 | 14,000 | 5,000 | (3) | 3,500 | 3,150 | 2,900 | 2,700 | 2,400 | 2,100 | 1,800 | | | | | |
| 51.80 | B-235 | | | | | | | | | | | | | | | | | |
| 51.80 | B-210 | 5154 | 5154-0 | 30,000 | 11,000 | (3) | 7,350 | 7,350 | 7,350 | 7,000 | 6,400 | | | | | | | |
| 51.80 | B-235 | | | | | | | | | | | | | | | | | |
| 51.80 | B-235 | 5456 | 5456-0 | 42,000 | 19,000 | | 10,500 | 10,400 | | | | | | | | | | |
| 51.80 | B-241 | | | | | | | | | | | | | | | | | |
| 51.80 | B-210 | 6063-T6W | 6063-T6W | [5] 17,000 | | | 4,250 | 4,200 | 4,000 | 3,800 | 3,600 | 2,750 | 1,900 | | | | | |
| 51.80 | B-235 | | | | | | | | | | | | | | | | | |
| 51.80 | B-241 | | | | | | | | | | | | | | | | | |
| 51.80 | B-210 | 6061-T6W | 6061-T6W | [5] 24,000 | | | 6,000 | 5,900 | 5,700 | 5,400 | 5,000 | 4,200 | 3,200 | | | | | |
| 51.80 | B-234 | | | | | | | | | | | | | | | | | |
| 51.80 | B-235 | | | | | | | | | | | | | | | | | |
| 51.80 | B-241 | | | | | | | | | | | | | | | | | |
| 51.70 | B-42 | Copper pipe | B42 | 30,000 | 9,000 | (3 10) | 6,000 | 6,000 | 5,900 | 5,800 | 5,000 | 3,800 | 2,500 | | | | | |
| 51.70 | B-42 | Copper pipe (2.00" and under). | B42 | 45,000 | 40,000 | (3 10 11) | 11,300 | 11,300 | 11,000 | 10,500 | 8,000 | 5,000 | 2,500 | | | | | |
| 51.70 | B-42 | Copper pipe (above 2.00"). | B42 | 36,000 | 30,000 | (3 10 11) | 9,000 | 9,000 | 8,700 | 8,300 | 8,000 | 5,000 | 2,500 | | | | | |
| 51.70 | B-43 | Red brass pipe | B43 | 40,000 | 12,000 | (3 10) | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | 6,000 | 3,000 | 2,000 | | | | |
| 51.73 | B-75 | Copper tubes | B75-A or -B | 30,000 | 9,000 | (3 10) | 6,000 | 6,000 | 5,900 | 5,800 | 5,000 | 3,800 | 2,500 | | | | | |
| 51.73 | B-75 | Copper tubes | B75-A or -B | 36,000 | 30,000 | (3 11) | 9,000 | 9,000 | 8,700 | 8,300 | 8,000 | 5,000 | 2,500 | | | | | |
| 51.73 | B-88 | Copper tubes | B88-K, -L or -M | 30,000 | 10,000 | (3) | 6,700 | 6,700 | 6,500 | 6,300 | 5,000 | 3,800 | 2,500 | | | | | |
| 51.73 | B-88 | Copper tubes | B88-K, -L or -M | 36,000 | 30,000 | (3 11) | 9,000 | 9,000 | 8,700 | 8,300 | 8,000 | 5,000 | 2,500 | | | | | |
| 51.73 | B-111 | Copper tubes | B111-A or-B | 30,000 | 10,000 | (3 10) | 6,700 | 6,700 | 6,500 | 6,300 | 5,000 | 3,800 | 2,500 | | | | | |
| 51.73 | B-111 | Copper tubes | B111-A or-B | 36,000 | 30,000 | (3 10 11) | 9,000 | 9,000 | 8,700 | 8,300 | 8,000 | 5,000 | 2,500 | | | | | |
| 51.73 | B-111 | Red brass tubes | B111-C | 40,000 | 12,000 | (3 10) | 8,000 | 8,000 | 8,000 | 8,000 | 8,000 | 6,000 | 3,000 | 2,000 | | | | |
| 51.73 | B-111 | Admiralty metal. | B111-D | 45,000 | 15,000 | (3 10) | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 8,000 | 5,000 | 3,000 | | | | |
| 51.73 | B-111 | Aluminum brass tubes. | B111-E | 50,000 | 18,000 | (3 10) | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 7,500 | 3,000 | 2,000 | | | | |
| 51.73 | B-111 | Copper nickel tubes 70-30. | B111-G | 52,000 | 18,000 | (3 10) | 12,000 | 11,600 | 11,300 | 11,000 | 910,800 | 10,600 | 10,300 | 10,100 | 9,900 | 9,800 | 9,600 | 9,500/9,400 |
| 51.73 | B-111 | Copper nickel tubes 80-20. | B111-H | 45,000 | 16,000 | (3 10) | 10,700 | 10,600 | 10,500 | 10,400 | 10,300 | 10,100 | 9,900 | 9,600 | 9,300 | 8,900 | 8,400 | 7,700/7,000 |
| 51.73 | B-111 | Copper nickel tubes 90-10. | B111-I | 40,000 | 15,000 | (3 10) | 10,000 | 10,000 | 9,800 | 9,500 | 9,300 | 9,000 | 8,700 | 8,300 | 7,500 | 6,700 | 6,000 | |
| 51.73 | B-111 | Aluminum bronze tubes. | B111-F | 50,000 | 19,000 | (3 10) | 12,500 | 12,400 | 12,200 | 11,900 | 11,600 | 10,000 | 6,000 | 4,000 | 2,000 | | | |
| Brazed pipe | | Copper | | | | | 3,000 | 3,000 | 3,000 | 3,000 | [12] 2,600 | | | | | | | |
| *Bars, rods, shapes and forgings* | | | | | | | | | | | | | | | | | | |
| 51.81 | B-247 | 3003F | 3003F | 14,000 | 5,000 | | 3,350 | 3,150 | 2,900 | 2,700 | 2,400 | 2,100 | 1,800 | | | | | |
| 51.82 | B-221 | 5083 | 5083 | 38,000 | 16,000 | | 9,500 | 9,500 | | | | | | | | | | |
| 51.82 | B-221 | 5154 | 5154 | 30,000 | 11,000 | (3) | 7,350 | 7,350 | 7,350 | 7,000 | 6,400 | | | | | | | |
| 51.82 | B-221 | 5456 | 5456 | 42,000 | 19,000 | | 10,500 | 10,400 | | | | | | | | | | |
| 51.82 | B-211 | 6061-T6 | 6061-T6 | 38,000 | 35,000 | (13) | 9,500 | 9,200 | 9,000 | 8,500 | 7,200 | 5,600 | 4,000 | | | | | |
| 51.82 | B-221 | | | | | | | | | | | | | | | | | |
| 51.82 | B-221 | 6061-T6W | 6061-T6W | [5] 24,000 | | | 6,000 | 5,900 | 5,700 | 5,400 | 5,000 | 4,200 | 3,200 | | | | | |
| 51.82 | B-211 | | | | | | | | | | | | | | | | | |
| 51.81 | B-247 | 6061-T6 | 6061-T6 | 38,000 | 35,000 | (13) | 9,500 | 9,200 | 9,000 | 8,500 | 7,200 | 5,600 | 4,000 | | | | | |
| 51.81 | B-247 | 6061-T6W | 6061-T6W | [5] 24,000 | | | 6,000 | 5,900 | 5,700 | 5,400 | 5,000 | 4,200 | 3,200 | | | | | |
| 51.81 | B-247 | 6063-T6 | 6063-T6 | 36,000 | 30,000 | (13) | 9,000 | 8,400 | 7,900 | 7,300 | 6,100 | 4,700 | 3,200 | | | | | |
| *Castings* | | | | | | | | | | | | | | | | | | |
| 51.76 [8] | B-61 | Steam bronze | 2A | 34,000 | 16,000 | (14) | 8,500 | 8,400 | 8,300 | 8,200 | 8,100 | 7,900 | 7,600 | 7,200 | | | | |
| 51.76 | B-62 | Ounce metal | 4A | 30,000 | 14,000 | (14) | 7,500 | 7,300 | 7,100 | 6,900 | 6,800 | 6,600 | [15] 6,500 | | | | | |
| 51.76 | B-143 | Tin bronze 1A | 1A | 40,000 | 18,000 | (14) | 8,000 | 8,000 | 7,000 | 6,000 | 5,500 | 5,000 | | | | | | |
| 51.76 | B-143 | Tin bronze 1B | 1B | 40,000 | 18,000 | (14) | 8,000 | 8,000 | 7,000 | 6,000 | 5,500 | 5,000 | | | | | | |

See footnotes at end of table.

TABLE 54.03-10(c)—MAXIMUM ALLOWABLE STRESSES[1] FOR NONFERROUS MATERIALS—Continued

| Specification | A.S.T.M. designation | Grade | | Minimum tensile strength p.s.i. | Minimum yield strength p.s.i. | Notes | For metal temperatures not exceeding ° F. | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A.S.T.M. | C.G. | | | | 100 | 200 | 300 | 400[2] | 500 | 600 | 700 | 800 | 900 | 1,000 | 1,100 | 1,200 |
| *Nickel copper plates and sheets* | | | | | | | | | | | | | | | | | | |
| 51.85 | B-127 | Hot or cold rolled. | B127 | 70,000 | 28,000 | | 17,500 | 16,500 | 15,500 | 14,800 | 14,700 | 14,700 | 14,700 | 14,500 | 8,000 | | | |
| 51.85 | B-127 | Hot rolled (as rolled). | B127 | 75,000 | 40,000 | | 18,750 | 17,500 | 17,000 | 17,000 | 17,000 | 17,000 | 16,500 | 14,500 | 4,000 | | | |
| *Nickel copper pipe or tubes* | | | | | | | | | | | | | | | | | | |
| 51.86 | B-163 | Nickel copper tubes (3" and under). | B163 | 70,000 | 28,000 | | 17,500 | 16,500 | 15,500 | 14,800 | 14,700 | 14,700 | 14,700 | 14,500 | 8,000 | | | |
| 51.86 | B-163 | Nickel copper tubes (½" to ⅞"). | B163 | 90,000 | 55,000 | [10] | 22,500 | 21,200 | 20,700 | 20,500 | 20,500 | 20,500 | 19,500 | 15,000 | | | | |
| 51.86 | B-163 | Nickel copper tubes (other sizes). | B163 | 85,000 | 55,000 | [10] | 21,200 | 20,200 | 19,500 | 19,200 | 19,200 | 19,200 | 18,500 | 15,000 | | | | |
| 51.86 | B-165 | Nickel copper pipe or tubes. | B165 | 70,000 | 28,000 | | 17,500 | 16,500 | 15,500 | 14,800 | 14,700 | 14,700 | 14,700 | 14,500 | 8,000 | | | |
| 51.86 | B-165 | Nickel copper pipe or tubes. | B165 | 85,000 | 55,000 | [10 17] | 21,200 | 20,200 | 19,500 | 19,200 | 19,200 | | | | | | | |

[1] All stresses refer to the annealed condition of the material, unless otherwise specified. For wrought material, the allowable "S" values are based upon one-fourth of the minimum tensile strength or two-thirds of the minimum yield strength for temperatures of 150° F. and below, whichever is lower; and upon creep stress or stress-rupture at the higher temperatures. For cast material, the allowable "S" values are based upon one-fifth of the minimum tensile strength for temperatures of 150° F. and below; and upon creep stress or stress-rupture at the higher temperatures.
[2] The same stress may be employed for a temperature of 406° F.
[3] The minimum yield strength employed not included in the specification.
[4] For nominal thickness not greater than 2.00-inch.
[5] Strength of reduced tensile specimen to qualify welding procedures, see § 54.03-1(g)(3).
[6] This material limited to a maximum allowable temperature of 212° F.
[7] This material approved for tube plates only.
[8] For nominal thickness not greater than 2.50-inch.
[9] For nominal thickness not less than 0.25-inch.
[10] The minimum tensile strength employed not included in the specification.
[11] These stresses refer to the light drawn condition.
[12] The same stress may be employed for 320° F.
[13] The stress values given for this material are not applicable when either welding or thermal cutting is employed.
[14] To these stresses a casting quality factor of 0.80 shall be used. This is not intended to apply to valves and fittings complying with A.S.A. standards.
[15] This stress is not permitted for temperatures exceeding 366° F.
[16] The stresses refer to the stress relieved condition.
[17] The maximum operating temperature is (arbitrarily) set at 500° F., because harder temper adversely affects design stress in the creep rupture temperature range.

### § 54.03-12 Cast-iron heads.

(a) The maximum allowable pressure and minimum thickness of circular cast-iron blank spherically dished heads concave to the pressure shall be calculated by the following formulas:

$$P=\frac{ST}{0.6R} \quad (1)$$

$$T=\frac{0.6PR}{S} \quad (2)$$

where:

$P$=maximum allowable pressure, in pounds per square inch.
$T$=thickness of dished portion of the head, in inches.
$R$=radius to which the head is dished measured on the concave side of the head, in inches (not to exceed the inside diameter of the shell to which the head is attached).
$S$=maximum allowable tensile stress, as given in table 54.03-1 (f), in pounds per square inch.

(b) Cast-iron heads of semi-ellipsoidal form in which the inside depth of the head (one-half of the minor axis of the ellipse) is not less than one-quarter of the inside diameter of the shell to which the head is to be attached, shall have a thickness of at least that required for a cast-iron shell of the same diameter.

(c) Heads flatter than the limits prescribed in this section for dished heads shall be designed as flat plates.

(d) Cast-iron dished heads integral with the cast shell shall have a corner radius equal to at least three times the thickness of the head.

### § 54.03-15 Tube sheets.

(a) The maximum allowable pressure and the minimum thickness of tube sheets shall be calculated by the following formulas:

**(1) Stationary or floating tube sheets of monoplate construction clamped between opposing contacts within the bolt circle and freely supported at edge with straight tubes** attached by expanding.

$$P=\frac{ST^3}{0.25D^3} \quad (1)$$

$$T=D\sqrt{\frac{0.25P}{S}} \quad (2)$$

**(2) Fixed or integral channel-tube sheets firmly secured all around edge, with straight tubes attached by expanding.**

$$P=\frac{ST^3}{0.16D^3} \quad (3)$$

$$T=D\sqrt{\frac{0.16P}{S}} \quad (4)$$

**(3) Bolted tube sheet having gaskets inside bolt circle, where the setting of the bolts tends to dish the tube sheet, with straight tubes attached by expanding.**

$$P=\frac{ST^3}{D^3\left[0.30+\frac{1.4\ Whg}{HD}\right]} \quad (5)$$

$$T=D\sqrt{\frac{P\left[0.30+\frac{1.4\ Whg}{HD}\right]}{S}} \quad (6)$$

**(4) Floating tube sheets which are of noncircular design with straight tubes attached by expanding.**

$$P=\frac{5T^3}{0.50D^3} \quad (7)$$

$$T=D\sqrt{\frac{0.50P}{S}} \quad (8)$$

where:

$P$=maximum allowable pressure, in pounds per square inch.
$S$=maximum allowable stress, 80 percent of the value as given in tables 52.05-10(a) or 54.03-10(c), in pounds per square inch.
$T$=minimum thickness of unreinforced tube sheet, measured at bottom of partition groove, in inches.
$D$=mean gasket diameter for flanged attachment; inside diameter of shell when bolted attachment is not employed; or shortest span for noncircular tube sheets measured to center line of gasket if bolted construction is employed; or to point of support if welded construction is employed; in inches.
$W$=flange design bolt load, in pounds. (See § 54.03-25 (c).)
$hg$=radial distance from the bolt-circle diameter to the diameter D, in inches.
$H$=total hydrostatic end force on area bounded by the mean diameter of the gasket or joint contact surface, in pounds.

(b) The minimum thickness of a tube sheet in which tubes are attached by expanding shall be not less than the outside diameter of the tubes.

(c) Tube sheet of a thickness less than that required by paragraph (a) may be considered by the Commandant where stiffened by ribs secured to the tube sheet by continuous penetration or double fillet welds. Such stiffeners will not be considered effective for a distance exceeding 30 plate thicknesses in calculating the section modulus.

(d) Where tubes are welded or brazed to a tube sheet and no expansion joint is employed in the shell construction, consideration may be given by the Commandant to the use of a tube sheet of lesser thickness than required by the formulas in this section, provided the

tube pitch is adequate for welding or brazing.

(e) U-tube tube sheets shall have a thickness of at least 1.25 times the thickness required for tube sheets with straight tubes.

(f) The pitch of tubes attached to tube sheets by roller expanding shall be not less than that specified in Table 54.03–15 (f), except that a lesser tube pitch may be authorized for heat exchangers, the failure of which will not affect the safety of the vessel, provided the manufacturer demonstrates by tests prescribed by the Commandant, using the types of material and identical fabricating procedures to be employed in construction, that he can produce equipment of acceptable workmanship and free of leakage.

TABLE 54.03-15 (f)—MINIMUM PITCH OF TUBES

| Outside diameter of tube, in inches | Pitch of tube, in inches |
|---|---|
| ½ and below | ⅝ |
| ⅝ | 1 3/16 |
| ¾ | 1 5/16 |
| 1 | 1¼ |
| 1¼ | 1 9/16 |
| 1½ | 1⅞ |

(g) Some types of arc- or gas-welded tube sheet attachments which are acceptable are illustrated in figure 54.03–15 (g).

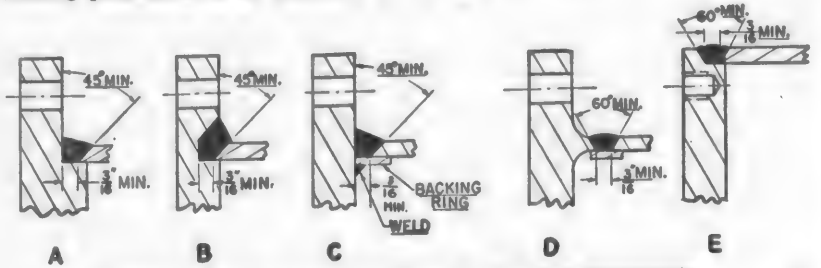



FIGURE 54.03–15 (g)—Acceptable types of tube sheet attachments.

**§ 54.03–20 Heat exchanger tubes.**

(a) The maximum allowable pressure and the minimum thickness of tubes for heat exchangers subject to internal pressure shall be calculated by the following formulas:

$$P = \frac{2.3\ ST}{D} - 0.036\ S \qquad (1)$$

$$T = \frac{D}{2.3\ S}(P + 0.036\ S) \qquad (2)$$

where:

$P$ = maximum allowable pressure, in pounds per square inch.

$S$ = maximum allowable stress, in pounds per square inch, as given in table 52.05–10 (a) or table 54.03–10 (c), at not less than the maximum expected mean wall temperature. The mean wall temperature is defined as the sum of the outside and inside surface temperatures divided by 2 where the temperature of the heating medium is considered to be for saturated steam at the design conditions and the temperature of the liquid or vapor being heated is the maximum temperature of the fluid at the hot terminal.

$T$ = minimum thickness of the tube wall, in inches.

$D$ = external diameter of the tube, in inches.

(b) Additional wall thickness above the minimum required by formula (2) of this section shall be provided as follows:

(1) When tubes act as stays, additional wall thickness shall be provided to carry the external load imposed upon the tubes.

(2) When tubes are expanded into the tube seats, at least one additional B. W. G. thickness shall be provided over a length at least equal to the width of the seat plus 1 inch.

(3) Bent tubes shall have the thickness increased when the radius is less than 5 times the outside diameter of the tube, to compensate for the reduction in wall thickness due to fabrication.

**§ 54.03–25 Bolted flanged connections.**

(a) *Scope.* (1) Bolted flanged connections conforming to the American Standard for Steel Pipe Flanges and Flanged Fittings (ASA B16.5) as given in Table 55.07–15 (e) (1) shall be used for connections to external piping and may be used for other flanged connections.

(2) Bolted flanged connections to pressure vessels and special flange designs other than those meeting the requirements of subparagraph (1) of this paragraph shall be designed in accordance with the requirements of this section.

(3) The regulations in this section may be applied to flanges having the gasket entirely within the inner edge of the bolt holes.

(4) This section shall not be construed to prohibit the use of other types of bolted flanged connections, such as flanges using full-face gaskets, or other means to provide effective restraint against flange deflection. Such designs may be used provided the design is acceptable to the Commandant.

(b) *Material.* (1) For temperatures not exceeding 450° F., commercial carbon-steel bolting material may be used for attaching heads, doors, covers, or flanges. Carbon-steel bolting and nut material shall comply with Subpart 51.49 of this subchapter. Bolting and nuts shall meet the minimum requirements of American Standard Coarse Thread Series. Nuts shall meet the requirements of American Standard Heavy Dimensions as given in Table 54.03–25 (b).

(2) For temperatures exceeding 450° F., high strength or alloy steel bolting and nut material complying with the requirements of Subpart 51.49 of this subchapter shall be employed. Nuts of the below classes shall not be used for temperatures exceeding the following: class 1, 750° F.; classes 2 and 2H, 800° F.; class 4, 900° F.; and class 3, 1,050° F. Bolting and nuts shall meet the minimum requirements of the American Standard Heavy Dimensions and the American Standard Threads for High Strength Bolting as given in table 54.03–25 (b). Washers are not required but when used shall be of forged rolled steel.

(3) Studs continuously threaded or bolts with the unthreaded portion reduced to the same diameter as that of the root of the thread, shall be employed when the temperature exceeds 450° F.

(4) Bolting shall have a length of thread engagement of not less than the normal thickness dimension of American Standard heavy nuts.

(5) In no case shall the size of a bolt be less than ½ inch in diameter.

(c) *Bolt loads*—(1) *Operating bolt load.* The minimum required operating

TABLE 54.03-25 (b)—BOLTING AND NUTS

[All dimensions given are in inches]

| Diameter | Commercial steel bolts | | High strength steel bolts | | American Standard heavy nuts semifinished hexagonal | | |
|---|---|---|---|---|---|---|---|
| | Number of threads [1] | Root area | Number of threads [1] | Root area | Width across flats (min.) | Width across corners (min.) | Nut thickness (min.) |
| ½ | 13 | 0.126 | 13 | 0.126 | 0.850 | 0.969 | 0.464 |
| 9/16 | 12 | .162 | 12 | .162 | .909 | 1.037 | .526 |
| ⅝ | 11 | .202 | 11 | .202 | 1.031 | 1.175 | .587 |
| ¾ | 10 | .302 | 10 | .302 | 1.212 | 1.382 | .710 |
| ⅞ | 9 | .419 | 9 | .419 | 1.394 | 1.589 | .833 |
| 1 | 8 | .551 | 8 | .551 | 1.575 | 1.796 | .956 |
| 1⅛ | 7 | .693 | 8 | .728 | 1.756 | 2.002 | 1.097 |
| 1¼ | 7 | .890 | 8 | .929 | 1.938 | 2.209 | 1.187 |
| 1⅜ | 6 | 1.054 | 8 | 1.155 | 2.119 | 2.416 | 1.310 |
| 1½ | 6 | 1.294 | 8 | 1.405 | 2.300 | 2.622 | 1.433 |
| 1⅝ | 5½ | 1.515 | 8 | 1.680 | 2.481 | 2.828 | 1.556 |
| 1¾ | 5 | 1.744 | 8 | 1.980 | 2.662 | 3.035 | 1.679 |
| 1⅞ | 5 | 2.049 | 8 | 2.304 | 2.844 | 3.242 | 1.802 |
| 2 | 4½ | 2.300 | 8 | 2.652 | 3.025 | 3.449 | 1.925 |
| 2¼ | 4½ | 3.021 | 8 | 3.423 | 3.388 | 3.862 | 2.155 |
| 2½ | 4 | 3.716 | 8 | 4.292 | 3.750 | 4.275 | 2.401 |
| 2¾ | 4 | 4.619 | 8 | 5.259 | 4.112 | 4.688 | 2.647 |
| 3 | 4 | 5.621 | 8 | 6.324 | 4.475 | 5.102 | 2.893 |

[1] All bolting shall have threads at least as strong as American Standard screw threads.

TABLE 54.03-25 (c1)—GASKET MATERIALS AND CONTRACT FACINGS

| GASKET MATERIAL | | GASKET FACTOR m | MIN. DESIGN SEATING STRESS y | SKETCHES | FACING LIMITATIONS | USE COL. |
|---|---|---|---|---|---|---|
| Rubber without fabric or a high percentage of asbestos fiber: Below 75 Shore Durometer | | 0.50 | 0 | | Use 1, 2, 3, 4 only | II |
| 75 or higher Shore Durometer | | 1.00 | 100 | | | |
| Asbestos with a suitable binder for the operating conditions | 1/8 thick | 2.00 | 1600 | | | |
| | 1/16 thick | 2.75 | 3700 | | | |
| | 1/32 thick | 3.50 | 6500 | | | |
| Rubber with cotton fabric insertion | | 1.25 | 400 | | None | |
| Rubber with asbestos fabric insertion, with or without wire reinforcement | 3-ply | 2.25 | 2200 | | | |
| | 2-ply | 2.50 | 2900 | | | |
| | 1-ply | 2.75 | 3700 | | | |
| Vegetable fiber | | 1.75 | 1100 | | 1, 2, 3 | |
| Spiral-wound metal, asbestos filled | Carbon | 2.50 | 2900 | | Use 1a, 2* only | |
| | Stainless | 2.50 | 6500 | | | |
| Serrated steel | Asbestos filled | 2.25 | 3700 | | | |
| Corrugated metal, Asbestos inserted or Corrugated metal, Jacketed asbestos filled | Soft aluminum | 2.50 | 2900 | | | |
| | Soft copper or brass | 2.75 | 3700 | | | |
| | Iron or soft steel | 3.00 | 6500 | | | |
| | Monel or 4-6% chrome | 3.25 | 5500 | | | |
| | Stainless steels | 3.50 | 6500 | | | |
| Corrugated metal | Soft aluminum | 2.75 | 3700 | | | |
| | Soft copper or brass | 3.00 | 6500 | | | |
| | Iron or soft steel | 3.25 | 5500 | | | |
| | Monel or 4-6% chrome | 3.50 | 6500 | | | |
| | Stainless steels | 3.75 | 7600 | | | |
| Flat metal jacketed asbestos filled | Soft aluminum | 3.25 | 5500 | | Use 1a, 2* ONLY | |
| | Soft copper or brass | 3.50 | 6500 | | | |
| | Iron or soft steel | 3.75 | 7600 | | | |
| | Monel | 3.50 | 6500 | | | |
| | 4-6% chrome | 3.75 | 9000 | | | |
| | Stainless steels | 3.75 | 9000 | | | |
| Grooved iron or soft steel with or without metal jacketed | Soft aluminum | 3.25 | 5500 | | Use 1, 2, 3 only | |
| | Soft copper or brass | 3.50 | 6500 | | | |
| | Iron or soft steel | 3.75 | 7600 | | | |
| | Monel or 4-6% chrome | 3.75 | 9500 | | | |
| | Stainless steels | 4.25 | 10100 | | | |
| Solid flat metal | Soft aluminum | 4.00 | 8800 | | None | I |
| | Soft copper or brass | 4.75 | 13000 | | | |
| | Iron or soft steel | 5.50 | 18000 | | | |
| | Monel or 4-6% chrome | 6.00 | 21800 | | | |
| | Stainless steels | 6.50 | 26000 | | | |
| Ring joint | Iron or soft steel | 5.50 | 18000 | | Use 4 only | |
| | Monel or 4-6% chrome | 6.00 | 21800 | | | |
| | Stainless steel | 6.50 | 26000 | | | |

* THE SURFACE OF A GASKET HAVING A LAP SHOULD BE AGAINST THE SMOOTH SURFACE OF THE FACING AND NOT AGAINST THE NUBBIN.

EFFECTIVE GASKET WIDTH

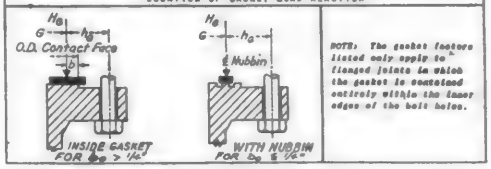
| FACING SKETCH (Corresponding) | BASIC GASKET SEATING WIDTH $b_o$ COLUMN I | BASIC GASKET SEATING WIDTH $b_o$ COLUMN II |
|---|---|---|
| 1a | $\frac{N}{2}$ | $\frac{N}{2}$ |
| 1b | $\frac{W+T}{2}\left(\frac{W+N}{4}\ \max\right)$ | $\frac{W+T}{2}\left(\frac{W+N}{4}\ \max\right)$ |
| 2 | $\frac{W+N}{4}$ | $\frac{W+3N}{8}$ |
| 3 | $\frac{W}{2}\left(\frac{N}{4}\ \min\right)$ | $\frac{W+N}{4}\left(\frac{3N}{8}\ \min\right)$ |
| 4 | $\frac{3N}{8}$ | $\frac{7N}{16}$ |
| 5 | | |
| 6 | $\frac{N}{4}$ | $\frac{3N}{8}$ |
| 7 | | |
| 8 | $\frac{W}{8}$ | |

EFFECTIVE GASKET SEATING WIDTH "b"

$b = b_o$, when $b_o \leq 1/4"$

$b = \frac{b_o}{2}$, when $b_o > 1/4"$

LOCATION OF GASKET LOAD REACTION




NOTE: The gasket factors listed only apply to flanged joints in which the gasket is contained entirely within the inner edges of the bolt holes.

bolt load $W_{m1}$ shall be determined by formula (1) under maximum operating conditions.

$$W_{m1} = H + H_p = 0.785\,G^2P + (2b \times 3.14\,GmP) \quad (1)$$

NOTE 1: Under maximum operating conditions the minimum required operating bolt load $W_{m1}$ is the load required to resist the hydrostatic end force $H$ exerted by the maximum internal pressure upon the area bounded by the mean diameter of the gasket, and, in addition, maintain a compression load $H_p$ on the gasket or joint-contact surface which experience has shown to be sufficient to insure a tight joint.

(2) *Initial bolt load.* The minimum required initial bolt load $W_{m2}$ shall be determined by formula (2) under atmospheric temperature conditions without consideration of internal pressure.

$$W_{m2} = H_y = 3.14\,bGy \quad (2)$$

NOTE 2: Under atmospheric temperature conditions without consideration of internal pressure, the minimum required initial bolt load $W_{m2}$ is the load $H_y$ required to seat the gasket or joint-contact surfaces sufficiently to insure a tight joint.

(3) *Bolt areas.* (i) The total required bolt area $A_m$ shall be determined from the greater of the values obtained from formula (3) under operating conditions, or from formula (4) under atmospheric temperature conditions without consideration of internal pressure.

$$A_{m1} = \frac{W_{m1}}{S_b} \quad (3)$$

$$A_{m2} = \frac{W_{m2}}{S_a} \quad (4)$$

(ii) The actual total cross-sectional area of the bolts $A_b$ shall be not less than $A_m$.

(4) *Flange design bolt load.* The bolt load $W$ used in the design of the flange shall be not less than the greater of the values obtained from formula (1) under maximum operating conditions, or from formula (5) under atmospheric temperature conditions without consideration of internal pressure.

$$W = \frac{(A_m + A_b)}{2} S_a \quad (5)$$

(5) *Nomenclature of bolt and flange design symbols.* The symbols used in this paragraph mean:

$W_{m1}$ = minimum required bolt load for maximum operating conditions, in pounds.
$W_{m2}$ = minimum required initial bolt load for atmospheric temperature conditions without consideration of internal pressure, in pounds.
$W$ = flange design bolt load, in pounds.
$H$ = total hydrostatic end force, in pounds.
$H_p$ = total joint-contact-surface compression load, in pounds.
$H_y$ = total joint-contact-surface-seating load, in pounds.
$G$ = mean diameter of gasket or joint-contact-surface, in inches (except for lap joints with full face gasket, in which case it is midpoint of contact between flange and lap).
$P$ = maximum allowable pressure, in pounds per square inch.
$b$ = effective gasket or joint-contact-surface seating width, in inches (see table 54.03-25 (c1)).
$2b$ = effective gasket or joint-contact-surface pressure width, in inches (see table 54.03-25 (c1)).
$N$ = possible contact width of gasket in inches (see table 54.03-25 (c1)).
$w$ = width of local concentration on gasket, in inches (see table 54.03-25 (c1)).
$m$ = limit contact compression factor (see table 54.03-25 (c1)).
$y$ = gasket or joint-contact-surface unit seating stress, in pounds per square inch (see table 54.03-25 (c1)).
$S_b$ = maximum allowable bolt stress at operating temperature, in pounds per square inch, as given in table 52.05-10 (a).
$S_a$ = maximum allowable bolt stress at atmospheric temperature, in pounds per square inch, as given in table 52.05-10 (a).
$A_m$ = total required cross-sectional area of bolts at root of thread or section of least diameter under stress, in square inches.
$A_b$ = total actual cross-sectional area of bolts at root of thread or section of least diameter under stress, in square inches.

(d) *Shell flange attachments.* (1) The flanges covered by this paragraph are intended to be used for shell attachments to tube sheets, channels and end covers of unfired pressure vessels and heat exchangers.

(2) Except as otherwise provided for in this paragraph, shell flange attachments shall comply with the requirements of § 55.07-15(f) of this subchapter.

(3) Ring flanges of the type shown in Figures 55.07-15 (f3) and (f6) may be

used for pressures not exceeding 300 p.s.i. and temperatures not exceeding 650° F.

(4) Ring flanges of the plate or slip-on type welded to the shell by means of full penetration welds may be used for pressures not exceeding 600 p.s.i. and temperatures not exceeding 700° F. Some acceptable types of full penetration welded joints are shown in Figure 52.25–45(d), details (a), (b), (c), (g), and (h).

**§ 54.03–27 Unfired steam boilers.**

(a) Unfired pressure vessels in which steam is generated shall be classed as unfired steam boilers except that pressure vessels known as evaporators or heat exchangers may be classed as unfired pressure vessels.

(b) Unfired steam boilers shall be constructed in accordance with the requirements of Part 52 or 54 of this subchapter. When the maximum allowable pressure exceeds 30 p.s.i., unfired steam boilers shall comply with the requirements for Class I pressure vessels.

(c) Unfired steam boilers shall be fitted with an efficient water level indicator, a pressure gage and a blowdown valve.

(d) An approved safety valve shall be fitted on unfired steam boilers as required by § 54.07–10.

**§ 54.03–30 Evaporators.**

(a) An evaporator in which steam is generated shall be fitted with an efficient water level indicator, a pressure gauge, and a blowdown valve.

(b) An approved safety valve shall be fitted on evaporators as required by § 54.07–10.

**§ 54.03–35 Access and inspection openings.**

(a) All unfired pressure vessels for use with compressed air or where subject to internal corrosion shall be provided with suitable manhole, handhole, or other inspection openings for examination and cleaning.

(b) Unless otherwise specified in this subchapter, the access and inspection openings in the shell or head of an unfired pressure vessel shall comply with the requirements of Subpart 52.24 of this subchapter for power boilers.

(c) (1) Vessels not exceeding 12 inches in inside diameter are not required to have inspection openings.

(2) Vessels over 12 inches but not exceeding 16 inches in inside diameter need not be provided with inspection openings if the vessels are fitted with two pipe connections of at least 1½ inches in pipe size which can be disconnected for inspection.

(d) All unfired pressure vessels which require access or inspection openings shall be equipped as follows:

(1) Vessels over 12 inches but less than 18 inches in inside diameter shall have at least two plugged, threaded inspection openings of not less than 1½ inches pipe size.

(2) Vessels 18 to 36 inches, inclusive, in inside diameter shall have at least two threaded pipe plug inspection openings of not less than 2 inches pipe size, or two handholes, or one manhole.

(3) Vessels over 36 inches in diameter shall have a manhole, except those whose shape or use make it impracticable, in which case they shall have at least two 4 x 6 inch handholes or two handholes of equivalent area.

(4) When handholes or plugged openings are used for inspection openings in place of a manhole, where permitted, one handhole or one plugged opening shall be placed in each head or in the shell near each head.

(5) Removable heads or cover plates may be used in place of the required openings provided they are equal at least to the required size of the required inspection openings.

**§ 54.03–40 Openings and reinforcements.**

(a) Unless otherwise specified in this subchapter, openings and reinforcements in the shell or heads of unfired pressure vessels shall comply with the requirements of Subpart 52.25 in Part 52 of this subchapter for power boilers.

(b) The thickness of nozzles attached to shells or heads of unfired pressure vessels shall be not less than that required for Schedule 40 pipe of the same diameter, and in no case shall the nozzle wall thickness be less than that determined by § 55.07–5 of this subchapter.

(c) (1) Screwed and flanged piping connections to the outlets on a pressure vessel shall comply with the requirements of Part 55 of this subchapter, except as otherwise provided for in this paragraph.

(2) Plate or slip-on type flange attachments to nozzles with full penetration welds may be used for pressures not exceeding 600 p.s.i. and temperatures not exceeding 700° F.

(d) Some types of acceptable arc-welded connections to shells, drums or headers are illustrated in figure 52.25–45 (d) in Part 52 of this subchapter.

## Subpart 54.07—Pressure-Relief Devices

**§ 54.07–1 General requirements.**

(a) Unfired pressure vessels, such as tanks, containing liquids, gases, or vapors, and in which steam is not generated, shall be protected by a relief valve set to relieve at a pressure not exceeding that for which the vessel is designed and of sufficient relieving capacity to prevent a pressure increase exceeding 10 percent above the maximum allowable pressure, except as provided for in paragraph (b) of this section.

(b) Where an additional hazard can be created by exposure of an unfired pressure vessel containing compressed gas to fire or other unexpected sources of external heat (for example, vessels used for the transportation of liquefied compressed gases) relief valves shall be capable of preventing the pressure from rising more than 20 percent above the maximum allowable pressure of the vessel. The minimum required relief valve capacities for liquefied compressed gases are in Part 38 of Subchapter D (Tank Vessels) and in Part 146 of Subchapter N (Dangerous Cargoes) of this chapter.

(c) Pressure-relief devices shall be constructed so that they can not be readily rendered inoperative, and shall be so located, and installed as to be readily accessible for inspection and repair.

(d) For certain pressure vessels containing substances that may render a relief valve inoperative, or where the installation of a relief valve is considered impracticable, the Commandant may authorize the use of a rupture disk in lieu of a relief valve, provided such pressure vessels contain liquids or vapors that are not lethal or noxious and the temperature of the contents does not exceed 212° F. When the use of rupture disks is approved by the Commandant, the installation shall comply with the requirements of § 54.07–20.

(e) The opening through all pipes and fittings between a pressure vessel and its pressure-relieving device shall have at least the area of the pressure-relieving device inlet, and in all cases shall have sufficient area so as not to unduly restrict the flow to the pressure-relieving device. The opening in the vessel shall be designed to provide direct and unobstructed flow between the vessel and its pressure-relieving device.

**§ 54.07–5 Relief valves.**

(a) All relief valves for use on unfired pressure vessels or on piping systems where approved safety valves are not required shall in general comply with the requirements for safety valve construction in Subpart 162.001 or 162.012 of Subchapter Q (Specifications) of this chapter and shall be designed to suitably meet the protection and service requirements for which they are intended, except that relief valves are not required to have huddling chambers for service other than steam.

(b) In no case shall the diameter of a relief valve be less than ½ inch.

(c) Cast iron may be employed in the construction of relief valves for pressures not exceeding 125 pounds per square inch and temperatures not exceeding 450° F. Seats or disks of cast iron are prohibited.

(d) Relief valves for steam or air service shall be provided with a substantial lifting device so that the disk can be lifted from its seat when the pressure in the vessel is 75 percent of that at which the valve is set to blow.

(e) If the design of a relief valve is such that liquid can collect on the discharge side of the disk, the valve shall be equipped with a drain at the lowest point where liquid can collect.

(f) The spring in a relief valve in service for pressures up to and including 250 pounds per square inch shall not be re-set for any pressure more than 10 percent above or 10 percent below that for which the relief valve is marked. For higher pressures, the spring shall not be re-set for any pressure more than 5 percent above or 5 percent below that for which the relief valve is marked.

(g) The capacities of relief valves shall be rated at pressures of 3 percent for steam, 10 percent for gases or vapors, and at 10 or 25 percent for liquids above

the pressure at which the valve is set to operate.

**§ 54.07–10 Safety valves.**

(a) An approved safety valve set to relieve at a pressure not exceeding that for which the shell is designed shall be fitted to all unfired steam boilers and evaporators, except the following:

(1) Unfired steam boilers and evaporators of the coil or tube type designed to operate with a steam inlet pressure not exceeding 15 p.s.i. gage.

(2) Evaporators of the atmospheric type designed for vapor discharge direct to a distiller with no shutoff valve in the discharge line. The distiller connected to atmospheric evaporators shall be fitted with a vent to obviate a buildup in pressure. In no case shall the vent be less than 1½ inches in diameter.

(b) Safety valves for use on unfired pressure vessels in which steam or pressure is generated shall comply with the requirements specified in Part 52 of this subchapter for power boilers when subject to pressures exceeding 30 p.s.i., and Part 53 of this subchapter for low pressure heating boilers when subject to pressures of 30 p.s.i. or less.

(c) The relieving capacity of evaporator safety valves required by paragraph (a) of this section shall be at least equal to the capacity of the orifice fitted in the steam supply to the evaporator. The orifice capacity shall be determined in accordance with Formula (1) or (2) as follows:

(1) Where the set pressure of the evaporator shell safety valve is 58 percent or less than the setting of the safety valve in the steam supply:

$$W = 51.45\ AP \qquad (1)$$

(2) Where the set pressure of the evaporator shell safety valve exceeds 58 percent of the setting of the safety valve on the steam supply:

$$W = 105.3\ A\sqrt{P_2\ (P - P_2)} \qquad (2)$$

where:

$W$ = the required orifice capacity, in pounds per hour.
$A$ = cross-sectional area of rounded entrance orifice, in square inches.[1]
$P$ = set pressure of steam supply safety valve, in pounds per square inch, absolute.
$P_2$ = set pressure of evaporator shell safety valve, in pounds per square inch, absolute.

[1] The orifice shall be installed near the steam inlet of the coils or tubes and where no orifice is employed the area used in the formula shall be that of the inlet connection or manifold.

(d) The relieving capacity of safety valves on unfired steam boilers shall not be less than the maximum generating capacity of the unfired steam boiler as certified by the manufacturer.

(e) On new installations and where the orifice size of an existing unfired steam boiler or evaporator is increased, an accumulation test shall be made by closing all steam outlet connections except the safety valves for a period of five minutes. When conducting the accumulation test, the water shall be at the normal operating level and the steam pressure shall be at the normal operating pressure, and while under this test the pressure shall not rise more than six percent above the safety valve setting.

**§ 54.07–15 Heat exchanger relief valves.**

(a) A heat exchanger with liquid in the shell and the heating medium in the tubes or coils, shall be fitted with a liquid relief valve meeting the requirement of § 54.07–1.

(b) (1) A heat exchanger with steam in the shell and liquid in the tubes or coils at a pressure exceeding that in the shell, shall have a liquid relief valve fitted to protect the shell against excess pressure.

(2) The discharge capacity of such relief valves shall be calculated on the basis of the discharge from one tube using the difference in pressures between that in the shell and that in the tubes, and shall be not less than that determined by the following formula:

$$Q = 29.81\ KD^2\sqrt{P_1 - P_2} \qquad (1)$$

where:

$Q$ = required relief valve discharge capacity, in gallons per minute, based on relief valve set pressure.
$P_1$ = pressure in the tube or coils, in pounds per square inch.
$P_2$ = set pressure of the shell relief valve, in pounds per square inch.
$D$ = internal diameter of the largest tube or coil, in inches.
$K$ = coefficient of discharge = 0.62.

**§ 54.07–20 Rupture disks.**

(a) Every rupture disk shall have a specified bursting pressure at a specified temperature, shall be marked with a lot number and shall be guaranteed by its manufacturer to burst at within 5 percent (plus or minus) of its specified bursting pressure.

(b) The specified bursting pressure at the coincident operating temperature shall be determined by bursting two or more specimens from a lot of the same material and of the same size as those to be used. The test shall be made in a holder of the same form and pressure area dimensions as that with which the disk is to be used.

(c) Where it is desired to minimize the loss by leakage through the safety or relief valve of liquids or vapors, the rupture disk may be installed between a safety or relief valve and the vessel, provided the following requirements are met:

(1) The bursting pressure of the disk does not exceed the maximum allowable pressure of the vessel.

(2) The connection between the rupture disk and the relief valve is provided with a pressure gauge, test cock, or free vent to atmosphere, to indicate when the rupture disk has leaked or burst.

(3) The opening provided through the rupture disk, after breakage, is sufficient to permit a flow equal to the capacity of the attached valve and there is no chance of interference with the proper functioning of the relief valve; but in no case shall this area be less than the inlet area of the relief valve.

**§ 54.07–25 Safety relief valves.**

(a) Unfired pressure vessels containing liquefied compressed gases and where required by the regulations of this subchapter, shall be fitted with one or more approved safety relief valves designed, constructed and flow-tested for capacity in conformance with Subpart 162.018 of Subchapter Q (Specifications) of this chapter.

(b) Each safety relief valve shall be set to start to discharge at a pressure not in excess of the maximum allowable pressure of the vessel and the combined relieving capacities of the safety relief valves shall be sufficient to prevent a rise of pressure in the vessel of more than 20 percent above the maximum allowable pressure when all the safety relief valves are blowing.

(c) The minimum rates of discharge of the safety relief valves for liquefied compressed gas service shall be not less than that required by the applicable regulations governing the transportation in bulk of the particular commodity.

NOTE: The requirements covering the transportation of liquefied petroleum gases in bulk may be found in Part 38 of Subchapter D (Tank Vessels) of this chapter. The requirements covering the transportation in bulk of certain liquefied compressed gases of a hazardous nature, but not considered flammable, may be found in Part 146 of Subchapter N (Dangerous Cargoes) of this chapter.

(d) (1) Except as otherwise specified in this paragraph, each safety relief valve shall be tested in the presence of an inspector before being placed in service. The tests shall satisfactorily indicate that the safety relief valves will start to discharge at a pressure not in excess of the design pressure of the tank.

(2) Safety relief valves fitted with a breaking pin and rupture disk need not be tested in the presence of a marine inspector before being placed in service. In lieu thereof, a certificate shall be furnished with the valve attested to by the manufacturer that the requirements of subparagraph (1) of this paragraph are met.

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## PART 55—PIPING SYSTEMS AND APPURTENANCES

### Subpart 55.01—General


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55.01–15 Affidavit.


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Subpart 55.17—Hydraulic Systems

55.17-1 Scope.
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55.17-25 Hydraulic hose and fittings.
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55.17-35 Hydraulic cylinders.
55.17-40 Tests.

AUTHORITY: The provisions of this Part 55 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426–4431, as amended, 4433, as amended, 4434, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404–409, 411, 412, 435, 481, 489, 366, 395, 363, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167-14, Nov. 26, 1954, 19 F.R. 8026; 167-20, June 18, 1956, 21 F.R. 4894; CGFR 56-28, July 24, 1956, 21 F.R. 5659; 167-38, Oct. 26, 1959, 24 F.R. 8857, unless as otherwise noted.

## Subpart 55.01—General

### § 55.01-1 Scope.

(a) This part contains requirements for the various ships' piping systems and appurtenances.

(b) The respective piping systems installed on vessels shall have the necessary pumps, valves, regulating valves, safety valves, relief valves, flanges, fittings, pressure gauges, liquid level indicators, thermometers, etc., for safe and efficient operation of the vessel.

(c) Piping systems which do not fully comply with the requirements of this subchapter may be accepted for installation on vessels subject to inspection provided:

(1) They are limited to handling petroleum and associated products for use in offshore drilling operations.

(2) The design, material and fabrication comply with the requirements of the American Petroleum Institute (API) for such piping.

### § 55.01-5 Definitions.

(a) *Piping.* The word "piping" within the meaning of the regulations in this subchapter, refers to fabricated pipes or tubes with flanges and fittings attached, for use in the conveyance of vapors, gases, or liquids, regardless of whether the diameter is measured on the inside or the outside.

(b) *Nominal diameter.* The term "nominal diameter" as used in this part, except in § 55.07-5 (a), means the commercial diameter of the piping.

### § 55.01-10 Plan approval.

(a) Plans in triplicate for new construction and major alterations showing the respective piping systems shall be submitted to the Officer in Charge, Marine Inspection, in the district in which the vessel is to be built, or alterations are to be made, except that when, due to location of the shipyard or design office, such a procedure would result in unnecessary delay in transmission, the plans may be forwarded directly to the Commandant (MMT), United States Coast Guard, Washington, D.C., 20226.

(b) Piping materials and appliances such as pipe, tubing, fittings, flanges, and valves, except safety valves as specified by Subpart 52.65 of this subchapter, are not required to be specifically approved by the Commandant, but shall comply with the applicable requirements for materials, construction, markings, and testing. Drawings listing material specifications and showing details of welded joints for pressure-containing appurtenances of welded construction shall be submitted in accordance with paragraph (a) of this section.

(c) (1) Prior to installation aboard ship, arrangement drawings and diagrams of the following systems shall be submitted for approval.

(i) Steam piping (arrangement drawings of systems exceeding 125 p. s. i. only are required to be submitted for approval).

(ii) Boiler feed and blowoff piping.

(iii) Fuel oil service, transfer and fill piping.

(iv) Fire-extinguishing systems including fire main and sprinkler piping, steam smothering and inert gas and foam.

(v) Bilge and ballast piping.

(vi) Salt water tank cleaning piping.

(vii) Vent, sounding and overflow piping.

(viii) Cargo piping.

(2) Diagrams only of the following systems shall be submitted for approval:

(i) Steam and exhaust piping (systems not exceeding 125 p. s. i.).

(ii) Compressed air piping.

(iii) Steam drain piping.

(iv) Refrigeration piping.

(v) Lubricating oil piping.

(vi) Condenser circulating water piping.

(vii) Hydraulic oil piping.

(viii) Internal combustion engine fuel piping.

(ix) Safety valve escape piping.

(x) Plumbing, deck drains and overboard discharge piping.

(d) Standard drawings of the following piping fabrication details shall be submitted for approval:

(1) Sea suction and discharge connections.

(2) Fabricated valves and fittings (class I and class II piping).

(3) Welded pipe joints (class I and class II piping).

(e) The plans shall include a list of material furnishing pipe diameters, wall thicknesses, design pressure, material specifications, type, size and pressure rating of valves, flanges, and fittings. Where piping systems are intended to convey superheated steam, the temperature of same shall be indicated. Pump capacities and pump shutoff heads shall appear on the piping diagrams.

### § 55.01-15 Affidavit.

A manufacturer of pipe, tubing, valves, flanges, pipe fittings, castings, forgings, and bolting shall file with the Commandant a duly executed copy of form CG-935A, certifying that the product furnished by him conforms to all the requirements given in this subchapter.

## Subpart 55.04—Piping Classification

### § 55.04-1 Scope.

Piping shall be divided into two classes, Class I and Class II.

### § 55.04-5 Class I piping.

(a) Class I piping includes the various systems conveying mediums exceeding either pressures or temperatures as set forth in Table 55.04-5.

TABLE 55.04-5—PRESSURE AND TEMPERATURE LIMITATIONS

| Service | Pressure, pounds per square inch | Temperature ° F. |
|---|---|---|
| Lethal gases and liquids | Any | Any |
| Gases and vapors | 150 | 650 |
| Water | 225 | 350 |
| Fuel oil | 150 | 150 |
| Lubricating oil | 225 | 400 |
| Liquefied compressed gases | 150 | |
| Cargo oil, Grades A through D | 225 | 150 |
| Cargo oil, Grade E | 225 | 400 |
| Cargo oil, asphalt | 225 | 400 |
| Heat transfer oils | 225 | 400 |
| Molten sulfur | 225 | 400 |

### § 55.04-10 Class II piping.

Class II piping shall include piping system conveying mediums at or below the pressures or temperatures specified in Table 55.04-5, except that exhaust piping from internal combustion engines may comply with the requirements for Class II piping.

## Subpart 55.07—Detail Requirements

### § 55.07–1 Material.

(a) Materials used in the manufacture of pipe, valves, flanges, fittings or bolting shall conform with the requirements of this part, and shall comply with the respective specifications of Part 51 of this subchapter unless alternate equivalent material is approved by the Commandant.

(b) Pipe and flange materials are acceptable for the pressures and temperatures listed in Table 55.07–1(b).

TABLE 55.07-1(b)—PIPING MATERIALS [1]

| Material specification subpart | A.S.T.M. specification | Grade | Maximum design | | Limitation |
|---|---|---|---|---|---|
| | | | Pressure p.s.i. | Metal temperature ° F. | |
| *Steel pipe* | | | | | |
| Seamless-carbon: | | | | | |
| 51.34 | A53 | P53–A, B | None | 750 | |
| 51.34 | A106 | P106–A, B, C | None | 800 | |
| Seamless-alloy: | | | | | |
| 51.34 | A335 | P1 | None | 875 | |
| 51.34 | A335 | P2 | None | 900 | |
| 51.34 | A335 | P3, P3b | None | 1,050 | |
| 51.34 | A335 | P11 | None | 1,050 | |
| 51.34 | A335 | P12 | None | 1,050 | |
| 51.34 | A335 | P21 | None | 1,050 | |
| 51.34 | A335 | P22 | None | 1,050 | |
| 51.34 | A312 | TP321, TP347 | None | 1,050 | |
| Electric-resistance welded: | | | | | |
| 51.34 | A53 | P53–RW–A, B | 350 | 650 | |
| 51.34 | A135 | P135–A, B | 350 | 650 | |
| Lap-welded: 51.34 | A53 | P53–LW | 250 | 450 | |
| Butt-welded: 51.34 | A53 | P53–BW | 250 | 450 | |
| *Wrought iron pipe* | | | | | |
| Lap-welded: 51.34 | A72 | P72–LW | 250 | 450 | |
| Butt-welded: 51.34 | A72 | P72–BW | 250 | 450 | |
| *Copper and copper-alloy pipe and tubing* | | | | | |
| Seamless copper: | | | | | |
| 51.70 | B42 | B42 | None | 406 | (2 3). |
| 51.73 | B75 | B75–A, B, C | None | 406 | (2 3). |
| 51.73 | B88 | B88–K, L, M | None | 406 | (2 3). |
| 51.73 | B111 | B111–A, B | None | 406 | (2 3). |
| Copper-alloy: | | | | | |
| 51.70 | B43 | B43 (Red brass) | None | 406 | |
| 51.73 | B111 | B111–C (Adm. metal) | None | 406 | |
| 51.73 | B111 | B111–D (Al-brass) | None | 450 | |
| 51.73 | B111 | B111–E (Al-bronze) | None | 450 | |
| 51.73 | B111 | B111–F (Red brass) | None | 406 | |
| 51.73 | B111 | B111–G (70–30 Cu-Ni) | None | 500 | |
| 51.73 | B111 | B111–H (80–20 Cu-Ni) | None | 500 | |
| 51.73 | B111 | B111–I (90–10 Cu-Ni) | None | 500 | |
| Brazed copper | | | 75 | 320 | (4). |
| *Plates* | | | | | |
| Carbon steel: | | | | | |
| 51.04 | A201 | A, B | 150 | [illegible]50 | (5 6). |
| 51.04 | A212 | C, D | 150 | 650 | (5 6). |
| 51.22 | A285 | C | 150 | [illegible]50 | (6). |

[1] The carbon content of the material listed in Table 55.07–1(b) shall not exceed 0.35 percent if welded fabrication is to be employed.
[2] Copper pipe shall not be used for hot oil service other than short flexible connections at the burners.
[3] Copper pipe shall be annealed prior to installation for Class I piping systems.
[4] Copper pipe fabricated with brazed longitudinal joints shall be limited to water or saturated steam service for the maximum pressure and temperature as indicated.
[5] These limitations apply only when plates are used as flange material. See Table 52.05–10(a) for maximum design temperatures of plate material used in the construction of pressure vessels.
[6] Not permitted for hubbed flanges. Ring type flanges may be machined from plate.

(c) Forged steel or cast steel, conforming to the requirements of Subparts 51.46 and 51.58 of this subchapter, may be used for the construction of valves and fittings for any system without pressure limitation, subject to the maximum design temperatures as specified in table 52.05–10 (a) in Part 52 of this subchapter. Grades F181–I and II, Subpart 51.46, may be used in the construction of valves and fittings for pressures and temperatures not exceeding those allowed for 300-pound service pressure rating for steel pipe flanges and flanged fittings.

(d) Bronze castings conforming to the requirements of Subpart 51.76, of this subchapter, for Grade 4A (ounce metal) may be used in the construction of valves and fittings for pressures not exceeding 150 pounds per square inch and temperatures not exceeding 366° F. Grade 2A (steam bronze) and Grades 1A and 1B (tin bronze) may be used for steam pressures not exceeding 300 pounds per square inch and temperatures not exceeding 450° F., and for hydraulic or compressed air service at higher pressures where the temperature does not exceed 150° F.

(e) (1) Malleable iron castings conforming to the requirements of Subpart 51.61 of this subchapter for Grade A1 or A2 material, may be used in the construction of valves and fittings for pressures not exceeding 300 pounds per square inch and temperatures not exceeding 450 degrees F. Grade B malleable iron may be used for pressures not exceeding 150 pounds per square inch and temperatures not exceeding 450 degrees F. Cast iron conforming to the requirements of Subpart 51.61 may be used in the construction of valves and fittings for maximum saturated steam service pressure of 125 pounds per square inch. Cast iron conforming to the requirements of Subpart 51.61 may also be used in the construction of valves and fittings for maximum liquid and gas service pressures of 100 pounds per square inch at 340 degrees F. and 150 pounds per square inch at 150 degrees F. or less. Intermediate values may be obtained by interpolation. For exceptions to these limits see subparagraphs (2), (3), and (4) of this paragraph.

(2) Malleable iron and cast-iron valves and fittings designed and marked for Class 300 refrigeration service may be used for such service, provided the pressure limitation of 300 pounds per square inch is not exceeded. Malleable iron flanges of this class may also be used in sizes 4 inches and smaller (oval and square design).

(3) Cast iron conforming to the requirements of Subpart 51.61 of this subchapter may be used in the construction of valves and fittings of special design for hydraulic systems. Prior to use of such valves and fittings for pressures exceeding 150 pounds per square inch, each design shall be subjected to a high shock test by a recognized testing laboratory as prescribed by the Commandant and shall show no fracture when subjected to the impact test.

(4) Nodular cast iron conforming to the requirements of Subpart 51.61 of this subchapter, Grade 60–45–15, may be used in the construction of valves and fittings complying with 125-pound and 250-pound cast iron standards, or 150-pound and 300-pound steel standards, and for temperatures not exceeding 650 degrees F. Adjusted pressure ratings for temperatures not exceeding 650 degrees F. shall be 80 percent of the steel ratings specified in ASA Standards listed in Table 55.07–15(e)(1), except as otherwise specified in this subchapter.

(f) Ferrous pipe used for salt-water service should be protected against corrosion by hot-dipped galvanizing or other suitable means.

(g) Carbon-steel bolting material conforming to the requirements of Subpart 51.49 of this subchapter may be used for temperatures not exceeding 450° F. For temperatures exceeding 450° F., alloy-steel bolting material as specified in Subpart 51.49 shall be employed.

(h) (1) Except as otherwise provided for in this paragraph, plastic pipe may be used for fresh and salt water supply to nonvital machinery and to all machinery fitted with a duplicate standby unit, and for other piping systems as may be authorized by the Commandant. Plastic pipe may be used in lines which lead through watertight decks or bulkheads provided a spool piece and shutoff valve constructed of an acceptable metallic material is fitted at the bulkhead. Such valves shall be operable from above the bulkhead deck. Plastic pipe shall not be used in any overboard discharge line outboard of the required overboard discharge valves.

(2) Plastic piping shall be limited to a maximum pressure of 150 p.s.i. and a maximum temperature of 140° F., or as may be authorized by the Commandant.

(3) Material used in the fabrication of plastic pipe shall be unplasticized rigid polyvinylchloride (PVC) or reinforced resins, or such other plastic material as may be authorized by the Commandant. The flammability of the plastic pipe shall not exceed the burning rate of the self-extinguishing type as determined by the standard ASTM test method (D–635).

(4) The wall thickness of plastic pipe shall not be less than Schedule 40 I. P. S. The pipe shall be designed to withstand a hydrostatic bursting pressure of not less than 5 times the maximum allowable pressure and shall have a minimum tensile strength of at least 5,000 p. s. i.

(5) Pipe joints shall be of the slip-sleeve, socket or screwed type. Screwed joints shall be used on pipe having at least Schedule 80 wall thickness.

(i) (1) Except as otherwise provided for in this paragraph, flexible hose and hose assemblies may be used for fresh and salt water supply to quarters, sanitary drains, cooling water supply to non-vital machinery and to all machinery fitted with a duplicate standby unit or duplicate piping system, and for other piping systems as may be authorized by the Commandant. Flexible hose may be used in lines which lead through watertight decks or bulkheads provided a spool piece and shutoff valve constructed of an acceptable metallic material are fitted at the bulkhead. Such valves shall be operable from above the bulkhead deck. Flexible hose shall not be installed outboard of the required overboard discharge valves.

(2) Nonmetallic flexible hose shall be fabricated with an inner tube and cover of synthetic rubber or other suitable material reinforced with wire braid. The material for the cover shall be fire-resistant. The inner tube shall be of seamless construction, uniform gage and shall be compatible with the substance carried therein.

(3) Piping systems using flexible hose shall be limited to a maximum pressure of 150 pounds per square inch except that short lengths of flexible hose may be installed in fuel and lubricating lines at or near machinery units and in pneumatic and hydraulic systems where flexibility is required. Unreinforced flexible hose may be used in water and pneumatic piping systems for pressures not exceeding 50 pounds per square inch. For flexible hose installed in hydraulic systems, see § 55.17–25.

(4) Flexible hose assemblies shall be designed for a bursting pressure of not less than 4 times the maximum allowable pressure.

(j) If it is desired to use materials other than those specified in this section, a request furnishing chemical and physical properties of the material which it is desired to employ shall be submitted to the Commandant for special consideration.

**§ 55.07–5 Design pressures and thickness of pipes.**

(a) (1) The maximum allowable pressure and minimum thickness of pipes shall be calculated by the following formulas:

$$P=\frac{2S\ (T-A)}{D-M\ (T-A)} \qquad (1)$$

$$T=\frac{PD}{2S+MP}+A \qquad (2)$$

where:

$P$=maximum allowable pressure, p. s. i.[1]

$T$=minimum wall thickness of pipe, inches.[2]

$D$=external diameter of pipe, inches.

$S$=Allowable fiber stress, p.s.i. When ferrous material is employed, the allowable fiber stress shall be 80 percent of the stresses as given in Table 52.05–10(a). When nonferrous material is employed, the allowable fiber stress shall be as given in Table 54.03–10(c).

$M$=Multiplier as given in Table 55.07–5(a).

$A$=Allowance for threading, grooving, and/or corrosion.

$A$=0.05 inch for threaded pipe ⅜ inch and below.

$A$=depth of thread $h$ for threaded pipe ½ inch and above.

$A$=depth of groove for grooved pipe.

$A$=0.05 inch for plain-end steel, wrought iron pipe or tubes, 1 inch size and smaller.

$A$=0.065 inch for plain-end steel, wrought iron pipe or tubes, for sizes above 1 inch.

$A$=0.00 inch for plain-end nonferrous pipe or tubes.

NOTE: The depth of thread $h$ may be determined by the formula $h=0.8/n$; where $n$=the number of threads per inch, or from the following values: $h$=0.100 inch, 0.0696 inch, and 0.0571 inch, for 8, 11½, and 14 threads per inch, respectively. "Plain-end" includes pipe joined by flared compression couplings, lap joints, welding, etc., i. e., by any method that does not reduce the wall thickness of the pipe at the joint.

[1] When computing the allowable pressure for a pipe, the pipe wall thickness used in formula (1) shall not be more than the minimum thickness resulting from the application of mill tolerances prescribed in the applicable pipe specifications for the material to be employed, including tubing material when used for piping. For bent sections of pipe, the reduction in wall thickness due to fabrication, in addition to the mill tolerance, shall be subtracted from the nominal pipe wall thickness to obtain the minimum pipe wall thickness.

[2] The wall thickness to which the pipe or tubing is ordered shall not be less than the sum of the minimum wall thickness determined by formula (2), plus the mill tolerance, and the reduction in wall thickness due to bending.

TABLE 55.07–5 (a)—MULTIPLIER "M" VALUES[1]

| Temperature ° F. | 900 and below | 950 | 1,000 | 1,050 |
|---|---|---|---|---|
| Ferrous materials: | | | | |
| Ferritic steels | 0.8 | 1.0 | 1.4 | 1.4 |
| Austenitic steels | 0.8 | 0.8 | 0.8 | 0.8 |
| Nonferrous materials | 0.8 | ------ | ------ | ------ |

[1] Intermediate values of "M" may be obtained by interpolation.

(2) The value of $P$ in the formula shall not be taken at less than 150 p. s. i. for class I piping nor less than 50 p. s. i. for nonferrous class II piping; however, copper piping shall be of not less than 0.065 inch in thickness except for lines below 1 inch in diameter, nor shall ferrous material to be fabricated by welding be of a thickness less than 0.120 inch.

(b) (1) The design pressures of the steam piping connected to the boiler drum or to the superheater inlet header shall be not less than the highest pressure at which any drum safety valve is set to blow.

(2) The design pressure of the superheater outlet flange and the superheated steam piping beyond the superheater outlet shall be not less than the pressure at which the superheater safety valve is set to blow. Where the superheater safety valve is of the drum pilot actuated type, the design pressure shall be at least equal to 95 percent of the drum pilot safety valve setting. The $S$ value for the material shall not exceed that permitted for the total steam temperature at the superheater outlet.

(c) Carbon steel or wrought iron pipe shall have a wall thickness of not less than standard weight pipe. Where the installation of light wall pipe is deemed satisfactory, the use of pipe having a wall thickness less than standard weight will be given special consideration by the Commandant.

(d) The outer walls of pipe bends after fabrication shall have a thickness of not less than that required by paragraph (a) of this section. If doubt exists as to the wall thickness being adequate, Class I piping having diameters exceeding 4 inches shall be drilled, gaged, and fitted with a screwed plug extending outside the pipe covering. Alternatively, a method of nondestructive examination such as the use of radiation measurement, ultrasonic or other acceptable method may be used. The nondestructive examination shall be employed where the design temperature exceeds 750° F. Prior to the use of nondestructive methods of examination by the above procedure, it shall be demonstrated by the user, in the presence of a marine inspector on specimens similar to those to be examined, that consistent results, having an accuracy of plus or minus 4 percent of the measurements secured by micrometers, are obtainable.

(e) The radius of a pipe bend measured from the centerline of the pipe shall be not less than three times the nominal pipe diameter, except for copper which shall have a radius of not less than twice the nominal pipe diameter.

(f) (1) Where pipe is pierced with tube holes the ligament efficiency of the tube holes shall be employed in the formulas in § 52.05–10 of this subchapter to determine the maximum allowable pressure of the piping. The pressure thus calculated shall in no case be greater than that allowed for the unpierced pipe.

(2) Where branch connections are welded to Class I piping, or to piping conveying steam at pressures exceeding 50 p. s. i., reinforcement of the pierced pipe shall be provided unless the connection is adequate for the design pressure. The amount of reinforcement required

shall be determined by § 52.25–20 of this subchapter.

(3) The longitudinal joint of a welded pipe shall not be pierced with holes.

(g) Sections of ferritic alloy steel piping shall be furnished in the full-annealed or normalized and drawn condition prior to installation. If the material is subject to hot bending or hot forming operations, the piping shall be re-normalized before welding. Following the normalizing treatment, piping over 2½ inches shall be re-drawn either before welding or after welding when a combined stress relief and drawn treatment may be performed simultaneously in the furnace. Material which is bent cold need not be re-normalized. The heat treatment of austenitic alloy steel piping subject to hot bending or other hot forming operations will receive special consideration by the Commandant. All scale shall be removed from normalized pipe prior to installation.

### § 55.07–6 Expansion and flexibility.

(a) Piping systems shall be designed to have sufficient flexibility to prevent thermal expansion or contraction from causing excessive stresses in the piping material, excessive bending moments at the joints, or excessive forces or moments at points of connection to equipment or at anchorage and guide points.

(b) Provision shall be made for expansion and contraction by changes in direction of pipe runs or by the use of expansion bends, loops, offsets, or movable joints that will provide adequate flexibility.

(c) Piping shall be installed to avoid excessive strains and shall be adequately supported by hangers or guides, so that the weight of the piping is not transmitted to valves and fittings, and the effects of vibrations, pitching and rolling of the vessel are minimized. Pipe supports shall be designed and arranged so as not to interfere with expansion and contraction of the piping and to insure that excessive forces and moments are not imposed on connected equipment. Anchors, pivots, and restraints shall be fabricated and installed to secure the desired points of piping in relatively fixed positions and freely permit expansion and contraction in opposite directions. Main junction points of piping subject to temperatures exceeding 450° F., which are not balance points, shall be fitted with fixed anchors. If considered as a balance point the junction point may be free to move in all directions, or may be guided to limit the movement in one or more directions if computations indicate excessive strain may occur in any of the branch pipes.

(d) A summary of the results of pipe stress calculations for the main and auxiliary steam piping where the design temperature exceeds 800° F., together with the arrangement piping drawings, shall be submitted for approval. Calculations shall be made in accordance with one of the recognized methods of stress analysis acceptable to the Commandant.

(e) Stress calculations shall be made to determine the magnitude and direction of the forces and moments at all terminal connections, anchor and junction points, as well as the resultant bending stress, longitudinal pressure stress, torsional stress, and combined expansion stress at all such points. The location of the maximum combined stress shall be indicated in each run of pipe between anchor points. Dimensional properties of pipe and fittings shall be based on nominal dimensions.

(f) (1) The combined expansion stresses shall be calculated by the following formula:

$$S_e = \sqrt{S_b^2 + 4S_t^2} \qquad (1)$$

where:

$S_e$ = combined expansion stress, in pounds per square inch.

$S_b = \frac{iM_b}{Z}$ = resultant bending stress, in pounds per square inch.

$S_t = \frac{M_t}{2Z}$ = torsional stress, in pounds per square inch.

$M_b$ = resultant bending moment, in inch-pounds.

$M_t$ = torsional moment, in inch-pounds.

$Z$ = section modulus of the pipe, cubic inches.

$i$ = stress intensification factor (see § 55.07–6 (g)).

(2) The calculations for the combined expansion stress, $S_e$, shall be based on 100 percent of the thermal expansion, using the modulus of elasticity at room temperature (cold condition). No credit will be allowed for cold pull in computing the combined expansion stress.

(3) The combined expansion stress shall not exceed the allowable stress range as determined by the following formula:

$$S_A = 1.25S_c + 0.25S_h \qquad (2)$$

where:

$S_A$ = allowable stress range, in p.s.i.

$S_c$ = Allowable stress in cold condition, in p.s.i. (80 percent of $S$ value given in Table 52.05–10(a) for piping material at 650° F.)

$S_h$ = Allowable stress in hot condition, in p.s.i. (80 percent of $S$ value give in Table 52.05–10(a) for piping materials at design temperatures.)

(4) The sum of the longitudinal stresses due to pressure, weight and other sustained external loadings shall not exceed $S_h$. Where the sum of these stresses is less than $S_h$, the difference between $S_h$ and the sum may be added to the term 0.25 $S_h$ in formula (2).

(g) Stress intensification factors for pipe bends and elbows, moduli of elasticity, and coefficients of thermal expansion shall conform to the values as specified in the American Standard Code for Pressure Piping (ASA B31.1).

(h) (1) The reactions in the hot condition, $R_h$, and cold condition, $R_c$, shall be calculated by the following formulas:

$$R_h = (1 - \tfrac{2}{3}C)\frac{E_h}{E_c}R \qquad (3)$$

$$R_c = CR \quad \text{or} \quad \left(1 - \frac{S_h}{S_e} \times \frac{E_c}{E_h}\right)R, \text{ whichever is greater.} \qquad (4)$$

The value $\frac{S_h}{S_e} \times \frac{E_c}{E_h}$ shall be less than unity.

where:

$R_c$ and $R_h$ = maximum reactions estimated to occur in the cold and hot conditions, respectively, pounds.

$R$ = range of reactions obtained from the flexibility calculations corresponding to the full expansion range based on the modulus of elasticity at room temperature, pounds.

$C$ = cold spring factor varying from zero for no cold spring to one for 100 percent cold spring.

$S_e$ = maximum computed expansion stress.

$E_c$ = modulus of elasticity in cold condition. (See § 55.07–6 (g).)

$E_h$ = modulus of elasticity in hot condition. (See § 55.07–6 (g).)

(2) The reactions so computed shall not exceed the limits which the attached equipment can safely sustain.

(3) Cold spring may be taken into account in the calculations of the reactions in the hot and cold conditions: *Provided*, That, in the opinion of the Commandant, satisfactory provision is made to obtain the designed cold spring.

(i) Where it is desired to employ alloy steel pipe materials of better heat resistant properties than those specified in Part 51 of this subchapter, special consideration may be given by the Commandant for an increase in the maximum allowable stress range, if satisfactory evidence is furnished to establish the suitability of the material for the design temperature.

### § 55.07–8 Variations in pressures and temperatures.

(a) Superheater outlet flanges and superheated and desuperheated steam piping direct from the boiler shall be designed for not less than the maximum pressure and temperature to which they may be exposed in service under normal sustained operating conditions.

(b) Occasional increases in pressure and/or temperature are unavoidable and may be permitted without changing the normal design provided the corresponding stress in the pipe wall calculated by Formulas (1) and (2) of § 55.07–5 does not exceed 80 percent of the maximum allowable stress value given in Table 52.05–10(a) in § 52.05–10 of this subchapter for the actual expected temperature by more than the following allowance for the periods of duration indicated:

(1) Up to 15 percent increase above the $S$ value during 10 percent of the operating period.

(2) Up to 20 percent increase above the S value during 1 percent of the operating period.

### § 55.07–10 Valves and fittings.

(a) All valves shall close with a right hand (clockwise) motion of the handwheels when facing the end of the valve stem. Valves shall be of the rising stem type preferably with the stem threads external to the valve body. Where operating conditions will not permit of such installations, the use of a non-rising stem valve will be permitted, provided indicators are fitted to show clearly whether same is opened or closed. Valves installed in cargo tanks of tank vessels are not required to be fitted with indicators.

(b) Valves of class I piping having diameters exceeding 2 inches shall have bolted, pressure seal, or breech lock bonnets and flanged or welding ends, except that socket type welding ends shall not be used where the diameter exceeds 2 inches. For diameters not exceeding 2 inches, screwed union bonnet valves or a type which will positively prevent the stem from screwing out of the body may be employed. Cast-iron valves with screwed-in or screwed-over bonnets are prohibited. Union bonnet type cast-iron valves shall have the bonnet ring made of steel, bronze or malleable iron.

(c) Valves, flanges, fittings and appurtenances shall be designed for the maximum pressure to which they may be subjected, but in no case shall the design pressure be less than 50 pounds per square inch. When butterfly or wafer type resilient seated valves are used for shell connections, the valve bodies shall be designed for 150 pounds per square inch. Large fabricated ballast manifolds connecting lines exceeding eight inches nominal pipe size may be designed for a pressure of not less than 25 pounds per square inch.

(d) Disks or disk faces, seats, stems and other wearing parts of valves shall be made of material possessing corrosion and heat-resisting qualities suitable for the service conditions to which they may be subjected.

(e) Valves, flanges, and fittings shall be marked in conformance with the requirements of MSS Standard SP–25–1960.[1]

(f) Plug cocks shall be constructed with satisfactory and positive means of preventing the plug from becoming loosened or removed from the body when the plug is operated. Cocks having plug locking arrangements depending on cotter pins are prohibited.

(g) Cocks shall be marked in a straight line with the body to indicate whether same are open or closed.

### § 55.07–15 Joints and flange connections.

(a) Flanged or butt-welded joints are required for Class I piping for diameters exceeding 2 inches, except as otherwise specified in this subchapter.

(b) Slip-on flanges in sizes not exceeding 2'' may be used without pressure limitations and for temperatures not exceeding 650 degrees F. Slip-on flanges in sizes exceeding 2'' may be used for pressures not exceeding the service pressure temperature ratings for the 300-pound ASA Standard and for temperatures not exceeding 650 degrees F. Screwed joints for Class I piping are not permitted for pipe diameters exceeding 2''.

(c) Forged or cast steel valves, flanges, and pipe fittings of the socket welding type, wherein the pipe is inserted into the socket and is secured by means of a strength fillet weld may be employed for pipe diameters not exceeding 2 inches for Class I piping and without diameter limitation for Class II piping.

(d) Valves, flanges and fittings may be attached to nonferrous pipe by means of soldering where the pressures do not exceed 10 pounds per square inch at 240° F. and 100 pounds per square inch at 150° F. For temperatures between 150° F. and 240° F. the pressure shall be proportionate. Silver brazing alloy shall be employed for temperatures and pressures exceeding the foregoing.

(e) (1) Flanges shall conform in strength at least to the dimensional standards listed in Table 55.07–15 (e1), except as otherwise specified in this subchapter.

TABLE 55.07–15(e1)—STANDARDS FOR FLANGED, BUTT-WELDING, AND SOCKET-WELDING VALVES, FITTINGS, AND PIPE FLANGES

| Type | Pressure rating | Standard | Notes |
|---|---|---|---|
| Cast iron | 125 | ASA B16.1–1960 | (1) |
| Do | 250 | ASA B16.2–1960 | (2) |
| Bronze | 150 | ASA B16.24–1962 | (3) |
| Do | 300 | ASA B16.24–1962 | (3) |
| Steel | 150 | ASA B16.5–1961 | (4) |
| Do | 300 | ASA B16.5–1961 | (4) |
| Do | 400 | ASA B16.5–1961 | (4) |
| Do | 600 | ASA B16.5–1961 | (4) |
| Do | 900 | ASA B16.5–1961 | (4) |
| Do | 1,500 | ASA B16.5–1961 | (4) |
| Do | 2,500 | ASA B16.5–1961 | (4) |
| Do | | ASA B16.9–1958 | (5) |
| Do | | ASA B16.11–1946 | (6) |

[1] American Standard Cast Iron Pipe Flanges and Flanged Fittings, Class 125, published by the American Society of Mechanical Engineers, 345 East 47th St., New York, N.Y., 10017.

[2] American Standard Cast Iron Pipe Flanges and Flanged Fittings, Class 250, published by the American Society of Mechanical Engineers, 345 East 47th St., New York, N.Y., 10017.

[3] American Standard Brass or Bronze Flanges and Flanged Fittings, 150- and 300-lb., published by the American Society of Mechanical Engineers, 345 East 47th St., New York, N.Y., 10017.

[4] American Standard Steel Pipe Flanges and Flanged Fittings, published by the American Society of Mechanical Engineers, 345 East 47th St., New York, N.Y., 10017.

[5] American Standard Steel Butt-Welding Fittings, published by the American Society of Mechanical Engineers, 345 East 47th St., New York, N.Y., 10017.

[6] American Standard Steel-Socket Welding Fittings, published by the American Society of Mechanical Engineers, 345 East 47th St., New York, N.Y., 10017.

(2) (i) The adjusted service pressure-temperature ratings for steel pipe flanges and flanged valves and fittings shall conform to the ASA standards as listed in Table 55.07–15(e1), except as otherwise specified in this subchapter.

(ii) The pressure-temperature ratings specified in American Standard Steel Pipe Flanges and Flanged Fittings, ASA B16.5, require gaskets and flange facings conforming to the requirements of such standards. For flange facing-gasket combinations other than those specified in ASA B16.5, calculations shall be submitted indicating that the gaskets will result in no increase in bolt load or flange moment over those facing-gasket combinations specified in this paragraph. (For acceptable gasket dimensions and flange facings, see Figure 54.03–25(c1) of this subchapter and ASA B16.5.)

(f) Flanges shall be attached to the pipe by any method shown by figures 55.07–15 (f1) to 55.07–15 (f15), inclusive, or by any additional means that may be approved by the Commandant.

(1) *Figure 55.07–15(f1).* Flanges with screwed threads may be used for class I piping not exceeding 2 inches nominal pipe size. For class II piping, flanges with screwed threads may be used without diameter limitation.

(2) *Figure 55.07–15(f2).* 150-pound and 300-pound low-hubbed flanges with screwed threads plus the addition of a strength fillet weld of the size as shown may be used for Class I piping without diameter limitation for temperatures not exceeding 750 degrees F. The pressure shall not exceed the American Standard service pressure temperature rating as prescribed in Table 55.07–15(e1).

(3) *Figure 55.07–15(f3).* Slip-on flanges in sizes exceeding 2'' may be used for pressures not exceeding the service pressure temperature ratings for the 300-pound ASA standards and for temperatures not exceeding 650 degrees F. Slip-on flanges in sizes not exceeding 2'' may be used without pressure limitations and for temperatures not exceeding 650 degrees F.

(4) *Figure 55.07–15(f4).* Socket welding flanges may be used for class I piping of nominal pipe size not exceeding 2 inches. For class II piping, socket welding flanges may be used without diameter limitation.

(5) *Figure 55.07–15(f5)* Flanges machined from steel plate meeting the requirements of Subpart 51.22 may be used for Class II piping for pressures not exceeding 150 pounds per square inch and temperatures not exceeding 450° F. The machined flanges shall conform at least to the American Standard 150 pound flange dimensions.

(6) *Figure 55.07–15 (f6).* Steel plate flanges meeting the material and construction requirements listed in Figure 55.07–15 (f5) may be used for Class II piping for pressures not exceeding 150 pounds per square inch or temperatures not exceeding 650 degrees F. The flange shall be attached to the pipe as shown by Figure 55.07–15 (f6). The pressure shall not exceed the American Standard service pressure temperature rating as prescribed in Table 55.07–15(e1).

(7) *Figure 55.07–15 (f7).* Lap joint flanges (Van Stone) may be used for class I and class II piping. The Van Stone equipment shall be operated by qualified personnel and the ends of the pipe shall be heated from 1,650° F. to 1,900° F. dependent upon the size of the pipe prior to the flanging operation. The foregoing temperatures shall be carefully adhered to in order to prevent excess scaling of the pipe. The extra thickness of metal built up in the end of the pipe during the forming operation shall be machined to restore the pipe to its original diameter. The machined surface shall be free from surface defects and the back of the Van Stone lap shall be machined to a fine tool finish to furnish a line contact with the mating surface on the flange for the full circumference as close as possible to the fillet of the flange. The number of heats to be used in forming a flange shall be determined by the size of the pipe and not more than two push-ups per heat are permitted. The width of the lap flange shall be at least three times the thickness of the pipe wall

[1] The "Standard Marking System for Valves, Fittings, Flanges and Unions," is published by Manufacturers Standardization Society of the Valves and Fittings Industry, 420 Lexington Avenue, New York, N.Y., 10017.

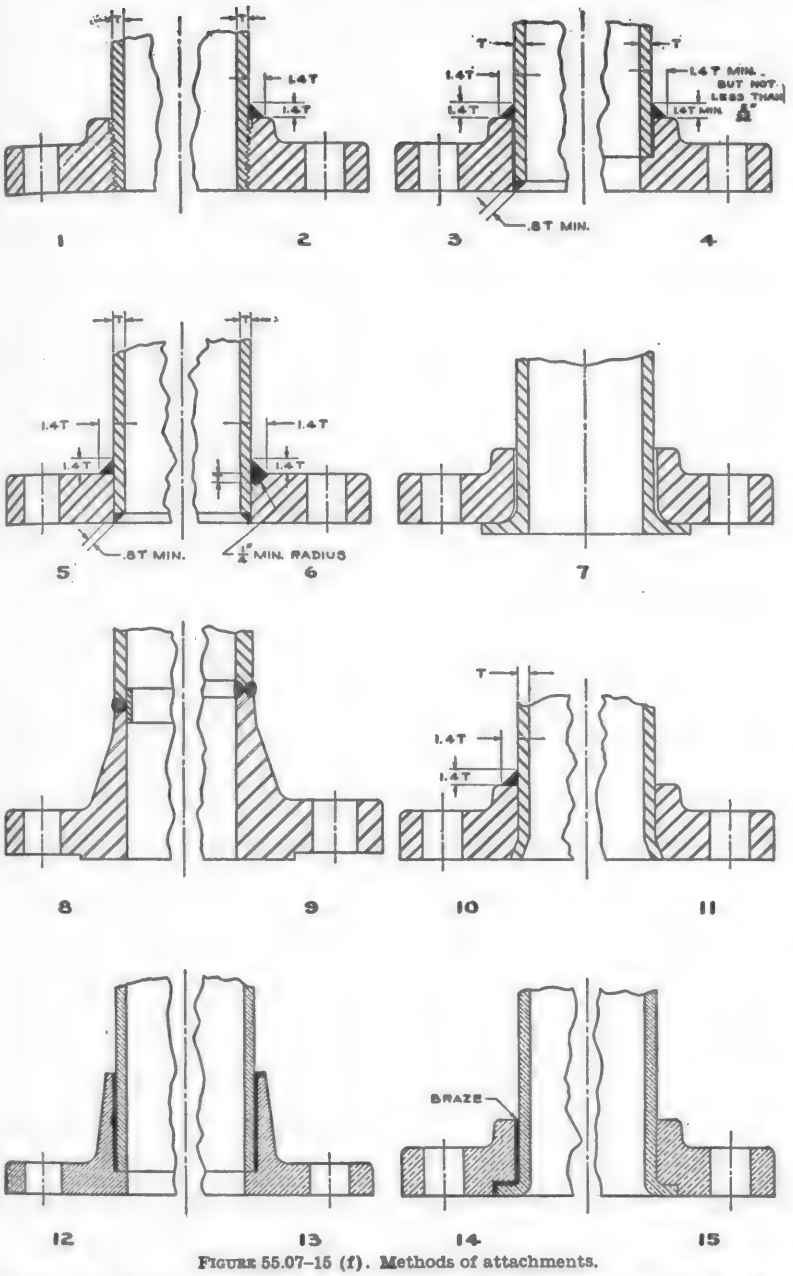


FIGURE 55.07–15 (f). Methods of attachments.

and the end of the pipe shall be properly stress-relieved after the flanging operation is completed. Manufacturers desiring to employ this type of joint shall demonstrate to an inspector that they have the proper equipment and personnel to produce acceptable lap joints.

(8) *Figure 55.07–15 (f8).* Welding neck flanges may be used on any piping provided the flanges are butt-welded to the pipe. The joint shall be welded as indicated by figure 55.07–15 (f8) and a backing ring employed which will permit complete penetration of the weld metal.

(9) *Figure 55.07–15 (f9).* Welding neck flanges may also be attached to pipe by a double-welded butt joint as shown by figure 55.07–15 (f9).

(10) *Figure 55.07–15 (f10).* Flanges may be attached by shrinking the flange on to the end of the pipe and flaring the end of the pipe to an angle or not less than 20°. A fillet weld of the size shown by figure 55.07–15 (f10) shall be used to attach the hub to the pipe. This type of flange is limited to a maximum pressure of 300 pounds per square inch at temperatures not exceeding 500° F.

(11) *Figure 55.07–15 (f11).* The flange of the type described and illustrated by figure 55.07–15 (f10), except with the fillet weld omitted, may be used for class II piping for pressures not exceeding 150 pounds per square inch and temperatures not exceeding 450° F.

(12) *Figure 55.07–15 (f12).* High-hub bronze flanges may be used for temperatures not exceeding 406° F. The hub of the flange shall be bored to a depth of not less than that required for a threaded connection of the same diameter leaving a shoulder for the pipe to butt against. A preinserted ring of silver brazing alloy having a melting point of not less than 1,000° F. and of sufficient quantity to fill the annular clearance between the flange and the pipe shall be inserted in the groove. The pipe shall then be inserted in the flange and sufficient heat applied externally to melt the brazing alloy until it completely fills the clearance between the hub and the flange of the pipe. A suitable flux shall be applied to the surfaces to be joined to produce a satisfactory joint. (For clearances of silver soldered joints, see § 56.10–30 (e) of this chapter.)

(13) *Figure 55.07–15 (f13).* The type of flange as described for figure 55.07–15 (f12) may be employed and in lieu of an annular groove being machined in the hub of the flange for the preinserted ring of silver brazing alloy, a bevel may be machined on the end of the hub and the silver brazing alloy introduced from the end of the hub to attach the pipe to the flange. (For clearances of silver soldered joints, see § 56.10–30 (e) of this chapter.)

(14) *Figure 55.07–15 (f14).* Flanges may be attached to nonferrous pipe by inserting the pipe in the flange and flanging the end of the pipe into the recess machined in the face of the flange to receive same. The width of the flange shall be not less than three times the pipe wall thickness. In addition thereto, the pipe shall be securely brazed to the wall of the flange.

(15) *Figure 55.07–15 (f15).* The flange of the type described and illustrated by figure 55.07–15 (f14), except with the brazing omitted, may be used for class II piping and where the temperature does not exceed 250° F.

### § 55.07–20 Bolting.

(a) Valves, fittings and flanges for piping systems shall have bolting complying with the standards for the different materials and pressure ratings as given in Table 55.07–15(e)(1). For the design requirements of bolted flanged connections on pressure vessels see § 54.03–25 of this subchapter.

(b) Bolting material shall comply with the requirements of § 54.03–25 of this subchapter.

### § 55.07–25 Installation.

(a) Slip joints shall not be used in cargo holds, deep tanks, and in other places that are not always accessible, except that they may be used in cargo lines of tank vessels. Where used, slip joints shall be provided with positive means for preventing the end of the pipe from pulling out of the joint.

(b) Pumps used to transfer oil shall have no discharge connections to firemains, boiler feed systems, or condensers unless approved positive means are pro-

vided to prevent oil from being accidentally discharged into any of the aforementioned systems.

(c) Where bilge or ballast piping are led through deep tanks means shall be provided to prevent the flooding of the compartments being served in the event of pipe leakage within the tanks. Such means may consist of an oiltight or watertight pipe tunnel, or the lines may be of Schedule 80 pipe thickness, fitted with expansion bends, and all joints within the tanks welded. Where a pipe tunnel is installed, the watertight integrity of the bulkheads shall be maintained and if the tunnel is not of sufficient size to afford easy access, no valve or fitting shall be located therein. Bilge lines led through deep tanks without a pipe tunnel shall be fitted with non-return valves at the bilge suctions.

(d) Where pipes and scuppers are carried through watertight or oiltight bulkheads, decks or tank tops, the watertight integrity of the structure shall be maintained. Lead or other heat sensitive materials shall not be used in piping systems which penetrate watertight subdivision bulkheads, where deterioration of such systems in the event of fire would impair the watertight integrity of the bulkheads. (For plastic pipe installations, see § 55.07–1(h).) Where plate insert pads are used, bolted connections shall have threads tapped into the plate to a depth of not less than the diameter of the bolt. If welded, the pipe or flange shall be welded to both sides of the plating. Openings in structure through which pipes pass shall be reinforced where necessary. Flanges shall not be bolted to bulkheads so that the plate forms a part of the joint.

(e) Piping shall not be run over or in the vicinity of switchboards or other electrical equipment if avoidable. When such leads are necessary, welded joints only shall be used and provision shall be made to prevent leakage from damaging the equipment.

(f) Fresh water piping shall not run through oil tanks nor oil piping through fresh water tanks. Care should be taken to prevent the accidental contamination of fresh water from salt water lines.

(g) Stuffing boxes shall not be used on deep tank bulkheads, double bottoms or in any position where they cannot be easily examined. This requirement does not apply to ore carriers operating on the Great Lakes or cargo lines of oil tankers.

(h) Piping systems shall be installed so that under no condition will the operation of safety or relief valves be impaired.

(i) (1) Remote valve controls which are not readily identifiable as to service shall be fitted with nameplates. Remote valve controls shall always be accessible under service conditions and an indicator shall be fitted to show whether the valve is open or closed. Valve control rods shall be adequately protected and only solid reach rods shall be used in tanks containing liquids, except that tank barges having plug cocks inside cargo tanks may have reach rods of extra heavy pipe with annular space between the lubricant tube and the pipe wall sealed with a non-soluble material to prevent penetration of the cargo.

(2) Where air operated remote control valves are installed, a self-indicating air cock and a pressure gauge or other acceptable means shall be provided in the actuating line to the remote valve as close as possible to the control board to indicate whether the remote control valve is open or closed.

(j) Suitable drains shall be provided at low points of piping systems.

(k) Valves and cocks shall be located so as to be easily accessible and valves or cocks attached to the shell of the vessel or to sea chests located below the floor plating shall be operable from above the floorplates.

(l) When welded fabrication is employed, a sufficient number of detachable joints shall be provided to facilitate overhauling and maintenance of machinery and appurtenances. The joints shall be located so that adequate space is provided for welding, and the location of the welds shall be indicated on the plans.

(m) (1) Pipes piercing the collision bulkhead shall be fitted with screwdown valves operable from above the bulkhead deck and the valve shall be secured to the bulkhead fitting inside the forepeak tank.

(2) Passenger vessels shall not have the collision bulkhead pierced below the margin line by more than one pipe conveying liquids in the forepeak tank except as provided for in subparagraph (3) of this paragraph.

(3) If the forepeak tank is divided to hold two different kinds of liquids, the collision bulkhead may be pierced below the margin by two pipes, provided there is no practical alternative to the fitting of the second pipe and further provided the safety of the vessel is maintained.

(n) Valves and cocks not forming part of a piping system are not permitted in watertight subdivision bulkheads.

(o) (1) Piping systems which may be subjected to pressures exceeding that for which same are designed shall be provided with a pressure reducing valve, and on the low pressure side of the reducing station a relief valve and pressure gauge shall also be installed.

(2) The relief valves installed on reduced pressure lines shall have a relieving capacity at least equal to the capacity of the pressure reducing valve at a pressure of not more than the design pressure of the reduced pressure piping or any appurtenance thereof, whichever is the lesser.

(p) Fuel oil service, cargo and fuel oil transfer and boiler feed pumps shall be provided with a pressure gauge. Relief valve shall also be installed in the discharge line provided the piping system or appurtenances are not designed for the pressure which such pumps are capable of developing when operating under shutoff head.

(q) Valves for fuel oil equalizing lines in machinery spaces shall comply with § 55.10–35 (d). Where flooding equalizing cross-connections are required for stability considerations, the arrangement shall be approved by the Commandant.

(r) Where pipes are run through cargo spaces and coal bunkers, they shall be substantially incased to protect them from mechanical injury. In coal bunkers such casings shall be made of steel.

(s) Piping, including valves, pipe fittings and flanges, conveying vapors, gases or liquids whose temperature exceeds 150 degrees F. shall be suitably insulated where necessary to preclude injury to personnel.

(t) Piping conveying oil shall be run well away from hot surfaces wherever possible. Where such leads are unavoidable, welded joints only shall be used, or alternatively suitable shields shall be fitted in the way of flanged or mechanical pipe joints when welded joints are not practicable.

(u) Oil piping drains, strainers, and other equipment subject to normal oil leakage shall be fitted with drip pans or other means to prevent oil draining to the bilge.

## Subpart 55.10—Pumping Arrangements and Piping Systems

### § 55.10–1 Steam and exhaust piping.

(a) Steam stop valves in sizes exceeding six inches shall be fitted with bypasses for heating the line and equalizing the pressure before the valve is opened.

(b) In multiple boiler installations, the steam stop valves shall be of the stop check type.

(c) Main and auxiliary steam stop valves shall be arranged to seat against boiler pressure.

(d) Where vessels are equipped with more than one boiler, the auxiliary steam piping shall be so arranged that steam for the whistle, steering gear, and electric-lighting plant may be supplied from any power boiler.

(e) Steam and exhaust pipes shall not be led through coal bunkers or dry cargo spaces unless approved by the Commandant.

(f) Steam piping with the exception of the steam heating system shall not be led through passageways, crew and passenger quarters, or public spaces unless the arrangement is approved by the Commandant. Steam pressure for space heating shall not exceed 45 p. s. i.

(g) (1) Where positive shutoff valves are fitted in exhaust lines of machinery, and the exhaust side, including engine steam cylinders and chests, turbine casings, exhaust piping and shutoff valves is not designed for the maximum inlet pressure, a full capacity relief valve shall be fitted between the machinery exhaust and the shutoff valve. The relief valve shall be of sufficient capacity and so set to prevent the equipment from being accidentally or otherwise subjected to a pressure in excess of its design pressure.

(2) A sentinel relief valve or other warning device fitted on the engine or turbine exhaust together with a back pressure trip device which will close the inlet valve when the exhaust side of the system is subjected to pressures exceeding the design pressure, may be substituted for the required relief valve.

(h) Control and instrument piping led from superheated steam lines shall be so arranged as to preclude an appreciable amount of condensate from entering the superheated steam line in order to minimize the likelihood of cracking due to thermal shock.

(i) Steam shore connections shall be fitted with a relief valve set at a pressure not exceeding the design pressure of the piping.

**§ 55.10–5 Safety and relief valve escape piping.**

(a) Escape piping from the boiler drum and superheater safety valves shall have an area of not less than that of the combined areas of the outlets of all valves discharging thereto and shall be led as near vertical as practicable to atmosphere.

(b) Expansion joints or flexible pipe connections shall be fitted in escape piping. The piping shall be adequately supported and installed so that no stress is transmitted to the safety valve body.

(c) Safety or relief valve discharges, when permitted to terminate in the machinery space, shall be led below the floorplates or to a remote position to minimize the hazardous effect of the escaping steam.

**§ 55.10–10 Boiler feed piping.**

(a) *General requirements.* (1) Steam vessels, and motor vessels fitted with steam driven electrical generators, shall have at least two separate means of supplying feed water for the boilers. All feed pumps shall be fitted with the necessary connections for this purpose. The arrangement of feed pumps shall be in accordance with paragraph (d) or (e) of this section.

(2) Feed pump supply to power boilers may utilize the group feed system or the unit feed system.

(3) Feed discharge piping shall be designed for not less than either (i) 125 percent of the maximum allowable pressure of the boiler; or (ii) the feed pump relief valve setting, or shutoff head when a pump relief valve is not fitted; whichever is the greater.

(4) Feed pumps for water tube boilers shall have fresh water connections only.

(b) *Feed valves.* (1) Stop and stop-check valves shall be fitted in the main feed line and shall be attached as close as possible to the drum feed inlet nozzles or to the economizer feed inlet nozzles on boilers fitted with integral economizers.

(2) Where the installation will not permit the feed stop valve to be attached directly to the drum inlet nozzle on boilers not fitted with economizers, a distance piece may be installed between the stop valve and the inlet nozzle.

(3) Feed stop or stop-check valves may be located near the operating platform on boilers fitted with economizers provided the piping between the valves and the economizer, exclusive of the feed valves and the economizer inlet nozzles, is installed without intervening flanged connections and all butt-welded joints 4 inches and above in size are completely radiographed.

(4) Auxiliary feed lines shall be fitted with stop valves and stop-check valves. Boilers not having auxiliary feed water nozzles, or where independent auxiliary feed lines are not installed, shall have the auxiliary feed line to the drum or economizer connected to the main feed line as close as possible to the main feed stop valves; and the valves in the auxiliary feed line shall be fitted as close as possible to the junction point.

(5) Boilers fitted with economizers shall have a check valve fitted in the economizer discharge and located as close as possible to the drum feed inlet nozzle. When economizer by-passes are fitted, a stop-check valve shall be installed in lieu of the aforementioned check valve.

(6) A sentinel valve shall be fitted to an economizer when a valved bypass is installed.

(c) *Feed-water regulators, feed-water heaters and grease extractors.* (1) Feed-water regulators, tubular feed-water heaters, and grease extractors, where installed, shall be fitted with bypasses.

(2) Feed-water regulators designed with a built-in bypass for emergency use need not be fitted with an external by-pass when installed in a feed system provided with an auxiliary feed line. All feed-water regulators installed in a unit feed system shall be fitted with an external bypass. Feed-water regulator bypasses shall be so arranged that the regular feed valves are in operation while the bypass is in use.

(3) A feed-water regulator may be interposed between the stop and stop-check valves in the feed lines.

(d) *Group feed system.* Group feed systems shall be provided with pumps and piping as follows:

(1) Oceangoing and Great Lakes steam vessels, having a feed pump attached to the main propelling unit, shall be provided with at least one independently driven feed pump. Each of these pumps shall be used exclusively for feed purposes and shall be capable of supplying the operating boilers at their normal capacity. In addition, a second independently driven pump, capable of supplying such boilers at 75 percent of their normal capacity, shall be provided for emergency use. This second pump may be used for other purposes.

(2) If two independently driven pumps are provided, each capable of supplying the boilers at their normal required operating capacity, and neither of which is used for other purposes, the third or emergency feed pump is not required. Where more than two independently driven feed pumps are provided, their aggregate capacity shall not be less than 200 percent of that demanded by the boilers at their required normal operating capacity.

(3) River or harbor steam vessels shall have at least two means for feeding the boilers; one of which shall be an independently driven pump, the other may be an attached pump, an additional independently driven pump, or an injector.

(e) *Unit feed system.* Unit feed systems shall be provided with pumps and piping as follows:

(1) The unit feed system may be used on vessels having two or more boilers. When the unit feed system is employed each boiler shall have its own independently driven main feed pump capable of supplying the boiler at its normal operating capacity. In addition there shall be an auxiliary independently driven feed pump of the same capacity which can be operated in place of and in conjunction with the main feed pump. In vessels with two boilers there shall be provided one auxiliary pump for each boiler. In vessels with three or more boilers, not more than two boilers may be served by any one auxiliary pump. The auxiliary pump may be so interconnected that any pump can feed any boiler.

(2) In the unit feed system, a separate feed line shall be provided for each boiler from its pumps. A separate auxiliary feed line is not required. The discharge from each pump and the feed supply to each boiler shall be automatically controlled by the level of the water in that boiler. In addition to the automatic control, manual control shall be provided.

**§ 55.10–13 Condensate pumps.**

Two means shall be provided for discharging the condensate from the main condenser, one of which shall be independent of the main propelling machinery. If one of the independent feed pumps is fitted with a direct suction from the condenser and a discharge to the feed tank, same will be acceptable for this purpose. On vessels operating on lakes (including Great Lakes), bays, sounds, or rivers, where provision is made to operate noncondensing, only one condensate unit will be required.

**§ 55.10–15 Blowoff piping.**

(a) Where blowoff valves are connected to a common discharge from two or more boilers, a non-return valve shall be provided in the line from each boiler to prevent accidental blow-back in the event the boiler blowoff valve is left open.

(b) Blowoff piping external to the boiler shall be designed for not less than 125 percent of the maximum allowable pressure of the boiler.

(c) Boiler blowoff piping which discharges above the load line of a vessel shall be arranged so that the discharge is deflected downward.

(d) Valves such as the globe type so designed as to form pockets in which sediment may collect shall not be used for blowoff service.

**§ 55.10–20 Circulating pumps.**

(a) A main circulating pump and emergency means for circulating water through the main condenser shall be provided. The emergency means may consist of a connection from an independent power pump fitted between the main circulating pump and the condenser.

(b) Independent sea suctions shall be provided for the main circulating and the emergency circulating pumps.

(c) A cross connection between the circulating pumps in the case of multiple

units will be acceptable in lieu of an independent power pump connection.

(d) On vessels operating on lakes (including Great Lakes), bays, sounds, or rivers, where provision is made to operate noncondensing, only one circulating unit will be required.

**§ 55.10–25 Bilge and ballast piping.**

(a)(1) All vessels except unmanned barges shall be provided with a satisfactory bilge pumping plant capable of pumping from and draining any watertight compartment except for ballast, oil and water tanks which have acceptable means for filling and emptying, independent of the bilge system. The bilge pumping system shall be capable of operation under all practicable conditions after a casualty whether the ship is upright or listed. For this purpose wing suctions will generally be necessary except in narrow compartments at the ends of the vessel, where one suction may be sufficient. In compartments of unusual form, additional suctions may be required.

(2) Arrangements shall be made whereby water in the compartments will drain to the suction pipes. Efficient means shall be provided for draining water from all tank tops, other watertight flats and insulated holds. Peak tanks, chain lockers and decks over peak tanks may be drained by eductors, ejectors or hand pumps. Where piping is led through the forepeak, see § 55.07–25(m).

(3) Where drainage from particular compartments are considered undesirable, the provisions for such drainage may be omitted, provided it can be shown by calculations that the safety of the vessel will not be impaired.

(b) Passenger vessels shall have provision made to prevent the compartment served by any bilge suction piping from being flooded in the event the pipe is severed or otherwise damaged by collision or grounding in any other compartment. Where the piping is located within one-fifth of the beam of the side of the vessel[1] or in a ductkeel, a nonreturn valve shall be fitted to the end of the pipe in the compartment which it serves.

(c)(1) Bilge suctions shall be led from manifolds, which shall be controlled above the floor plating in the compartments in which they are located, and shall be easily accessible at all times. Except as otherwise permitted by paragraph (i) of this section for Great Lakes' cargo vessels employing a common bilge and ballast system for the cargo spaces, valves in the machinery space controlling bilge suctions from various compartments shall be of the stop-check type.

(2) Passenger vessels engaged on international voyages shall have the manifolds and valves in the bilge pumping system so arranged that in the event of flooding, one of the bilge pumps can take suction on any compartment; and in addition, damage to a pump or its pipe connecting to the bilge main outboard of a line drawn at one-fifth of the beam of the vessel shall not put the bilge system out of action.

(3) If a bilge system common to all pumps is installed on passenger vessels engaged on international voyages, the necessary valves for controlling the bilge suctions shall be operable from above the bulkhead deck. If, in addition to the main bilge pumping system, an emergency bilge pumping system is installed, it shall be independent of the main system and so arranged that a pump is capable of operating on any compartment under flooding conditions. In such cases, only the valves necessary for the operation of the emergency bilge system need be capable of being operated from above the bulkhead deck.

(d) The internal diameter of bilge suction pipes shall be determined by the following formulas, except that the nearest commercial size not more than one-fourth inch under the required diameter may be used.

(1) For suctions to each main bilge pump:

$$d=1+\sqrt{\frac{L\ (B+D)}{2{,}500}} \qquad (1)$$

(2) For branch suctions to cargo and machinery spaces:

$$d=1+\sqrt{\frac{c\ (B+D)}{1{,}500}} \qquad (2)$$

where:

$L$ = length of vessel, in feet on load waterline.
$B$ = breadth of vessel, in feet.
$D$ = molded depth to bulkhead deck, in feet.
$c$ = length of compartment, in feet.
$d$ = required internal diameter of suction pipe, in inches.

NOTE: For tankers $L$ may be reduced by the combined length of the cargo oil tanks.

(3) For vessels of 150 gross tons and over, no main suction piping shall be less than 2½ inches internal diameter. Branch piping need not be more than 4 inches and shall not be less than 2 inches in diameter except for drainage of small pockets or spaces in which case 1½ inch diameter may be used. For vessels less than 150 gross tons no bilge suction shall be less than 1½ inches internal diameter and no branch piping shall be less than one inch nominal pipe size.

(4) For vessels of 65 feet in length or less and not engaged on an international voyage, the bilge pipe sizes computed by formulas (1) and (2) of this paragraph are not mandatory, but in no case shall the size be less than 1 inch nominal pipe size.

(5) The number, location and size of bilge suctions in the boiler and machinery compartments shall be determined when the piping plans are submitted for approval and shall be based upon the size of the compartments and the drainage arrangements.

(e) One of the independent bilge pumps shall have a suction of a diameter not less than that given by formula (2) led directly from the engineroom bilge entirely independent of the bilge main, and on passenger vessels each independent bilge pump located in the machinery spaces shall have such direct suctions from these spaces, except that not more than two pumps are required to have direct suctions from any one space. Where two direct suctions are required in any one compartment on passenger vessels, one suction shall be located on each side of the compartment. If watertight bulkheads separate the engine and boiler rooms, a direct suction or suctions shall be fitted to each compartment unless the pumps available for bilge service are distributed throughout these compartments, in which case at least one pump in each such compartment shall be fitted with direct suctions in its compartment.

(f)(1) Main circulating pumps shall be fitted with direct suction connections provided with nonreturn valves in the machinery space. Great Lakes cargo vessels may have the emergency bilge suction connected to the largest available pump in the machinery space, provided it has a capacity not less than that of the main circulating pump. The diameter of such suction pipes shall be not less than two-thirds of the diameter of the main sea inlet. Where coal is used as fuel and no watertight bulkhead is provided between the engine and boiler rooms, a direct discharge overboard shall be fitted from at least one circulating pump, or a bypass may be fitted to the circulating discharge.

(2) Where the main circulating pump is not suitable for emergency bilge service, a direct emergency bilge suction shall be led from the largest available independent power driven pump to the drainage level of the machinery space. The suction shall be not less than the diameter of the main inlet of the pump used. The discharge capacity of the connected pump shall exceed the capacity of a required main bilge pump. The pump used for emergency bilge suction shall be in addition to the bilge pumps required by § 55.10–30, and the independent bilge suction(s) stipulated in paragraph (e) of this section.

(g) For internal-combustion engine installations, the emergency bilge suction shall be connected to the largest available pump in the engineroom and shall have an area equal to the full suction inlet of the pump. This requirement is in addition to the independent bilge suction stipulated in paragraph (e) of this section.

(h) Each individual bilge suction shall be fitted with a suitable bilge strainer having an open area of not less than three times that of the suction pipe. In addition a mud box or basket strainer shall be fitted in an accessible position between the bilge suction manifold and the pump.

(i) Pipes for draining cargo or machinery spaces shall be separate from pipes which are used for filling or emptying spaces where water or oil is carried. Bilge and ballast pumping systems shall be so arranged as to prevent oil or water from the sea or ballast spaces from passing into cargo or machinery spaces, or from passing from one compartment to another, whether from the sea, water

[1] Measured at right angles to the centerline at the level of the deepest subdivision load line or deep load line, where subdivision load line is not assigned.

ballast or oil tanks. The bilge and ballast mains shall be fitted with separate control valves at the pumps. The requirements of this paragraph do not apply to bilge and ballast systems on Great Lakes cargo vessels which may employ a common line for the bilge and ballast system for the cargo spaces.

(j) Ballast piping shall not be installed to any hull compartment of a wooden vessel. Where the carriage of liquid ballast in such vessels is necessary, suitable ballast tanks, structurally independent of the hull, shall be provided.

(k) When cargo is to be carried in deep tanks, arrangements shall be made for disconnecting or blanking-off the oil and ballast lines, and the bilge suctions shall be disconnected or blanked-off when oil or ballast is carried. Blind flanges or reversible pipe fittings may be employed for this purpose.

(l) When bilge pumps are utilized for other services, the piping shall be so arranged that under any condition at least one pump will be available for drainage of the vessel through an overboard discharge, while the other pump(s) are being used for a different service.

(m) All bilge pipes used in or under fuel storage tanks or in the boiler or machinery space, including spaces in which oil settling tanks or oil pumping units are located, shall be of steel or other acceptable material.

(n) Oily water separators, if installed as a means of meeting the requirements of § 74.15–10 of Subchapter H (Passenger Vessels), § 93.13–10 of Subchapter I (Cargo and Miscellaneous Vessels), or § 35.01–40 of Subchapter D (Tank Vessels) of this chapter, shall be of sufficient capacity to provide acceptable separation under the least favorable anticipated service conditions.

(Sec. 8, 75 Stat. 403; 33 U.S.C. 1007. Treasury Department Order 167–46, Nov. 6, 1961, 26 F.R. 10609)

### § 55.10–30 Bilge pumps.

(a) *Self-propelled vessels.* (1) All self-propelled vessels shall be provided with power pumps connected to the bilge main as required in table 55.10–30(a).

(2) On passenger vessels 300 feet or more in length engaged in international voyages, or on all passenger vessels on international voyages having a criterion numeral of 30 or more, one of the power bilge pumps shall be available at all times for use under emergency conditions in which a vessel may be flooded at sea. One of the following installations will be considered as complying with the requirements of this paragraph.

(i) One of the required bilge pumps is an emergency pump of a reliable submersible type, the source of power for which shall be located above the bulkhead deck; or,

(ii) The bilge pumps and their sources of power are located throughout the ship so that under any condition of flooding which the vessel is required to withstand, at least one pump will be available in an undamaged compartment.

(3) One of the required power bilge pumps may be attached to the propelling engine.

TABLE 55.10–30 (a)—POWER BILGE PUMPS REQUIRED FOR SELF-PROPELLED VESSELS

| Vessel length | Passenger vessels | | | Dry cargo vessels | | Tank vessels |
|---|---|---|---|---|---|---|
| | International voyage [1] | Ocean, coastwise, and Great Lakes | All other | Ocean, coastwise, and Great Lakes | All other | All |
| 180 feet or more | [2] 3 | [2] 3 | 2 | 3 | 2 | 2 |
| Below 180 feet and exceeding 65 feet | [2] 3 | [2] 2 | [2] 2 | [2] 2 | [2] 2 | 2 |
| 65 feet or less | 3 | 1 | 1 | 1 | 1 | 1 |

[1] Not applicable to passenger vessels which do not proceed more than 20 miles from the nearest land, or which are employed in the carriage of large numbers of unberthed passengers in special trades.
[2] When the criterion numeral exceeds 30, an additional independent power driven bilge pump is required. (See Subpart 73.10 of Part 73 of Subchapter H (Passenger Vessels) of this chapter for determination of criterion numeral.)
[3] Vessels operating on lakes (including Great Lakes), bays, sounds, or rivers where steam is always available, or where suitable water supply is available from a power pump of adequate pressure and capacity, syphons or eductors may be substituted for one of the required power pumps, provided a syphon or eductor is permanently installed in each hold or compartment.

(4) The bilges forward of the cargo tanks on tank ships may be drained by a power or hand pump, syphons, or eductors. If syphons or eductors are employed, the same shall be permanently installed in each compartment.

(5) On Great Lakes cargo vessels which do not employ a common bilge main, the pumps used for bilge suction are not required to be connected to a bilge main.

(b) *Nonself-propelled vessels.* (1) Oceangoing sailing vessels and barges shall be provided with pumps connected to the bilge main as required in table 55.10–30 (b).

TABLE 55.10–30 (b)—BILGE PUMPS REQUIRED FOR NON-SELF-PROPELLED VESSELS

| Type of vessel | Waters navigated | Power [1] pumps | Hand pumps |
|---|---|---|---|
| Sailing | Ocean and coastwise. | 2 | [2] |
| Manned barges | do | 1 | [2] |
| Unmanned barges | All | [3] | [3] |

[1] Where power is always available, independent power bilge pumps shall be installed as required and shall be connected to the bilge main.
[2] Efficient hand pumps connected to the bilge main may be substituted for the power pumps. Where there is no common bilge main, one hand pump will be required for each compartment.
[3] Suitable hand or power pumps or siphons, portable or fixed, carried either on board the barge or on the towing vessel shall be provided.

(2) The pumps and source of power for operation on oceangoing sailing vessels and barges shall be located above the bulkhead deck or at the highest convenient level which is always accessible.

(c) *Capacity of independent power bilge pump.* Each power bilge pump shall have a capacity of developing a suction velocity of not less than 400 ft. per minute through the size of pipe required by § 55.10–25 under ordinary conditions, except that for vessels of less than 65 ft. in length not engaged on international voyages the pump shall have a minimum capacity of 25 gallons per minute and need not meet the velocity requirement of this paragraph.

(d) *Priming.* Suitable means shall be provided for priming centrifugal pumps which are not of the self-priming type.

(e) *Location.* (1) If the engines and boilers are in two or more watertight compartments, the bilge pumps shall be distributed throughout these compartments. When the location of bilge pumps in separate watertight compartments is not possible, the Commandant will consider alternate arrangements of the bilge pumps.

(2) The emergency bilge pumps shall not be installed in a passenger ship forward of the collision bulkhead.

(f) *Other pumps.* Sanitary, ballast, and general service pumps having the required capacity may be accepted as independent power bilge pumps if fitted with the necessary connections to the bilge pumping system.

### § 55.10–35 Fuel oil and cargo oil systems.

(a) Oil-piping systems for the transfer or discharge of cargo or fuel oil shall be separate from other piping systems as far as practicable, and positive means shall be provided to prevent dangerous interconnection in service.

(b) When it is necessary to heat the oil to facilitate its transfer, heating coils shall be properly installed in the tanks. The drains from the heating coils as well as the steam drains from oil heaters in the service system shall be run to an open inspection tank or other suitable oil detector before being returned to the feed tank.

(c) Filling pipes may be led directly from the deck into the tanks or to a manifold in an accessible location permanently marked to indicate tanks to which they are connected and from which the oil can be distributed to the various tanks through the piping system. The end of filling pipes shall be fitted with a shutoff valve which shall be kept closed when not in use. Alternate arrangements where gravity systems for filling are employed will be given special consideration by the Commandant.

(d) (1) Piping subject to internal head pressure from oil in the tank shall be fitted with positive shutoff valves located at the tank.

(2) Valves installed on the outside of the oil tanks shall be made of steel or nodular cast iron (Grade 60–45–15) and shall be arranged for local manual control at the valve and from a readily accessible and safe location outside of the compartment in which the valves are located.

(3) If valves are installed on the inside of the tank, they may be made of cast iron and arranged for remote con-

trol only, but additional valves for local control shall be located in the machinery space at the tanks. Valves for local control outside the tanks shall be made of steel or nodular cast iron (Grade 60–45–15).

(4) Remote operation for shutoff valves on small independent fuel-oil tanks will be specially considered in each case where the size of tanks and their location may warrant the omission of remote operating rods.

(e) Fuel oil tanks overhanging boilers are prohibited.

(f) Outlets for drawing fuel or draining water from the fuel oil system are not permitted in machinery spaces. Test cocks shall not be fitted to fuel or cargo oil tanks.

**§ 55.10–40 Fuel oil service systems.**

(a) All discharge piping from the fuel oil service pumps to the burners shall be of Schedule 80 seamless steel.

(b) (1) All vessels having oil fired power boilers shall have at least two fuel-oil service pumps each of sufficient capacity to supply all the boilers at full power, and arranged so that one may be overhauled while the other is in service. At least two fuel-oil heaters of approximately equal capacity shall be installed and so arranged that any heater may be overhauled while the other(s) are in service. Suction and discharge strainers shall be of the duplex or other type capable of being cleaned without interrupting the oil supply. Coamings, drip pans, etc. shall be fitted under fuel oil service pumps, heaters, etc. where necessary to prevent oil drainage to the bilge.

(2) All auxiliary boilers, except those furnishing steam for vital equipment and fire-extinguishing purposes other than duplicate installations, may be equipped with a single fuel-oil service pump and single fuel-oil heater, and in addition such pumps need not be fitted with discharge strainers.

(3) Boilers burning fuel oils of low viscosity need not be equipped with fuel oil heaters, provided acceptable evidence is furnished to indicate that satisfactory combustion will be obtained without the use of heaters.

(c) Piping between service pumps and burners shall be located so as to be readily observable. The relief valve located at the pump and the relief valves fitted to the fuel-oil heaters shall discharge back into the fuel supply tank or the suction side of the pump. The return line from the burners shall be so arranged that the suction piping cannot be subjected to discharge pressure.

(d) If screwed-bonnet valves are employed, same shall be of the union-bonnet type capable of being packed under pressure.

(e) Unions shall not be used for pipe diameters of one inch and above.

(f) Bushings and street ells are not permitted in fuel oil discharge piping.

(g) Service oil pumps shall be equipped with means of control from a readily accessible position outside of the boiler room which will always be accessible in the event of fire occurring in the compartment in which the pumps are located.

**§ 55.10–45 Gasoline fuel systems.**

(a) *Material.* (1) Fuel supply piping to the engines shall be of seamless drawn annealed copper tubing or iron pipe size copper pipe.

(2) Tubing wall thicknesses shall not be less than that shown in Table 55.10–45 (a).

TABLE 55.10–45 (a)—TUBING WALL THICKNESS

| Outside diameter of tubing in inches | Thickness | |
|---|---|---|
| | B. W. G. | Inch |
| ⅛, 3/16, ¼ | #21 | 0.032 |
| 5/16, ⅜ | #20 | .035 |
| 7/16, ½ | #19 | .042 |

(3) Tubing fittings shall be of nonferrous drawn or forged metal and of the flared type. Tubing shall be cut square and flared by suitable tools. Tube ends shall be annealed before flaring. Pipe fittings shall be of nonferrous material. Pipe thread joints shall be made tight with a suitable compound.

(4) Valves for fuel lines shall be of nonferrous material of the union-bonnet type with ground seats. Cocks are prohibited for use in gasoline fuel lines.

(b) *Installation.* (1) All fuel pipes, pipe connections and accessories shall be readily accessible. The piping shall run in sight wherever practicable, protected against mechanical injury, and effectively secured against excessive movement and vibration by the use of soft nonferrous metal liners or straps without sharp edges. Where passing through steel decks or bulkheads, fuel lines shall be protected by close fitting ferrules or stuffing boxes.

(2) A short length of suitable metallic or nonmetallic flexible tubing or hose, or a loop of copper tubing shall be installed in the fuel supply line at or near the engine to prevent damage by vibration. A nonmetallic flexible hose fabricated of a synthetic rubber adequately reinforced with either a suitable fabric or wire may be used for this purpose. The hose shall be designed for high resistance to petroleum oils, heat and vibration. Flexible hose connections should maintain metallic contact between the sections of the fuel supply lines; however, if such contact is not maintained, the fuel tank shall be grounded.

(3) Valves in fuel lines shall be installed to close against the flow.

(c) *Shutoff valves.* Shutoff valves of a suitable type shall be installed in the fuel supply lines, one as close to each tank as practicable, and one as close to each carburetor as practicable. Where fuel tanks are installed below the weather deck, arrangements shall be provided for operating all shutoff valves at the tanks from outside the compartments in which they are located, preferably from an accessible position on the weather deck. The operating gear for the shutoff valves at the tanks shall be accessible at all times.

(d) *Strainers.* A suitable twin strainer shall be fitted in the fuel supply line in the engine compartment. Strainers shall be of the type opening on top for cleaning screens. A drip pan shall be fitted under the strainer.

(e) *Outlets and drains.* Outlets in fuel lines for drawing gasoline for any purpose are prohibited. Valved openings in the bottom of fuel tanks are prohibited, however, openings fitted with threaded plug or cap may be used for cleaning purposes.

(f) *Fuel suction connections.* All fuel suction and return lines shall enter the top of the fuel tanks and connections shall be fitted into spuds. Such lines shall extend nearly to the bottom of the tank.

(g) *Filling and sounding pipes.* Filling and sounding pipes shall be so arranged that vapors or possible overflow when filling cannot escape to the inside of the vessel but will discharge overboard. Such pipes shall terminate on the weather deck clear of any coamings and shall be fitted with suitable shutoff valves or deck plugs. Filling and sounding pipes shall extend to within one-half of their diameter from the bottom of the tank or from the surface of the striking plate in case of a sounding pipe. A flame screen of noncorrodible wire mesh shall be fitted in the throat of the filling pipe. Sounding pipes shall be kept closed at all times except during sounding.

(h) *Vent pipes.* Each tank shall be fitted with a vent the net cross-sectional area of which shall be not less than that of the filling pipe. The vent pipes shall terminate at least two feet above the weather deck and not less than three feet from any opening into living quarters or other below deck space. The ends of vent pipes shall terminate with U-bends and shall be fitted with flame screens or flame arresters. The flame screens shall consist of a single screen of corrosion resistant wire of at least 30 x 30 mesh.

(i) *Gasoline tanks.* For requirements pertaining to gasoline tanks, see Subpart 59.05 of this subchapter.

**§ 55.10–50 Diesel fuel system.**

(a) *Scope.* The regulations in this section apply to motorboats and motor vessels of less than 100 gross tons and tank barges. For all other vessels, the diesel fuel system shall comply with §§ 55.10–35, 55.10–60 and 55.10–65.

(b) *Material and workmanship.* Fuel supply piping shall be of seamless steel or annealed seamless copper or brass pipe or tubing.

(c) *Installation.* The installation of diesel fuel piping shall comply with the requirements of § 55.10–45(b).

(d) *Shutoff valves.* Shutoff valves shall be installed in the fuel supply lines, one as close to each tank as practicable, and one as close to each fuel pump as practicable. Valves shall be accessible at all times.

(e) *Outlets and drains.* Valves for removing water or impurities from fuel oil systems will be permitted in the machinery space provided such valves are fitted with caps or plugs to prevent leakage.

(f) *Filling pipe.* Tank filling pipes on motorboats and motor vessels of less than

100 gross tons and tank barges shall terminate on an open deck and shall be fitted with suitable shutoff valves, deck plugs, or caps.

(g) *Vent pipes.* Each tank shall be fitted with a vent pipe complying with § 55.10–45 (h).

(h) *Diesel fuel tanks.* For requirements pertaining to diesel fuel tanks see Subpart 59.10 of this subchapter.

**§ 55.10–55 Lubricating oil system.**

(a) The lubricating oil system shall be designed to function satisfactorily when the vessel is permanently inclined to an angle of 15 degrees athwartship and 5 degrees fore or aft.

(b) When pressure or gravity forced lubrication is employed for the steam driven main propelling machinery, an independent auxiliary lubricating pump shall be provided.

(c) Oil coolers on steam driven machinery shall be provided with two separate means of circulating water through the coolers.

(d) For internal combustion engine installations, the requirements of paragraphs (b) and (c) of this section shall be met but do not apply to vessels in river and harbor service, nor in any vessel below 300 gross tons. Where the size and design of an engine is such that lubrication before starting is not necessary and an attached pump is normally used, the independent auxiliary pump is not required if a duplicate of the attached pump is carried as spare. Oil filters shall be provided on all internal combustion engine installations, and on main propulsion engines which are fitted with full-flow type filters the arrangement shall be such that the filters may be cleaned without interrupting the oil supply.

(e) The lubricating oil piping shall be independent of other piping systems and shall be provided with necessary coolers, heaters, filters, etc., for proper operation. Oil heaters shall be fitted with bypasses.

(f) Diesel engine lubrication systems shall be so arranged that vapors from the sump tank may not be discharged back into the engine crank case of engines of the dry sump type.

(g) Steam turbine driven propulsion and auxiliary generating machinery depending on forced lubrication shall be arranged to shut down automatically upon failure of the lubricating system.

**§ 55.10–60 Vent piping.**

(a) The structural arrangement in double bottom and other tanks shall be such as to permit the free passage of air and gases from all parts of the tanks to vent pipes.

(b) Tanks having a comparatively small surface, such as fuel oil settling tanks, need be fitted with only one vent pipe, but tanks having a comparatively large surface shall be fitted with at least two vent pipes. The vents shall be located so as to provide venting of the tanks under any service condition.

(c) Vent pipes for fuel oil tanks if not run vertically shall, wherever possible, be inclined not less than 30 degrees from the horizontal except on common headers where both ends are adequately drained to a tank.

(d) Vents of fresh water tanks shall extend above the weather deck unless same terminate within the machinery space, in which case they shall terminate well above the deep load line. Vents from ballast and fuel oil tanks shall extend above the weather deck and the vents from oil tanks shall terminate not less than 3 feet from any opening into living quarters.

(e) Vents from fuel oil and other tanks extending above the freeboard or superstructure deck shall be of substantial construction. The height from the deck to the opening at the inside of the return bend shall be at least 36 inches in wells on freeboard decks, 30 inches on raised quarter-decks and 18 inches on other superstructure decks, except on Great Lakes vessels where the height from the deck to the opening shall be, when practical, at least 30 inches in wells on freeboard decks, 24 inches on raised quarter-decks, and 12 inches on other superstructure decks. Where height of vent pipes on Great Lakes vessels may interfere with the working of the vessel a lower height may be approved provided the vent cap is properly protected. Satisfactory means are to be provided for closing the openings of the vents.

(f) Vent outlets from oil tanks shall be fitted with a single screen of corrosion-resistant wire, of at least 30 by 30 mesh, or two screens of at least 20 by 20 mesh, spaced not less than ½ inch nor more than 1½ inches apart. The clear area through the mesh shall not be less than the required area of the pipe. Satisfactory means shall be provided for closing the openings of vent pipes without damaging flame screens.

(g) The diameter of each vent pipe shall not be less than 1½ inches for fresh water tanks, 2 inches for water ballast tanks and 2½ inches for fuel oil tanks.

(h) Where tanks may be filled by a pressure head exceeding that for which the tank is designed, the aggregate area of the vents in each tank shall be at least equal to the area of the filling line unless the tanks are protected by overflows, in which case the area of the overflow shall not be less than that of the filling line.

(i) Where deep tanks are intended for the occasional carriage of dry or liquid cargo, a "spectacle" or ring and blank flange may be fitted in the overflow pipe so arranged as not to interfere with venting when the tanks contain oil.

**§ 55.10–65 Sounding devices.**

(a) All tanks shall be provided with a suitable means of determining liquid level. In lieu of sounding pipes, tanks for the carriage of Grade E or lower liquids which are separate from the hull may be provided with a reliable liquid level indicating device. Where such devices are attached to tanks for combustible liquids, they shall be of heat resistant materials, adequately protected from mechanical damage and shall be provided at the tank connections with devices which will automatically close in the event of rupture of the gage or gage lines. Except for main cargo tanks on tank vessels, all integral hull tanks and compartments, which are not at all times accessible under service conditions shall be fitted with sounding pipes.

(b) Where sounding pipes terminate below the freeboard deck on cargo vessels, same shall be fitted with gate valves, and on passenger vessels, where the valves terminate below the bulkhead deck, same shall be fitted with self-closing gate valves.

(c) The upper ends of sounding pipes terminating at the weather deck shall be closed by a screw cap or plug except that dry cargo carriers operating on the Great Lakes may have the sounding pipes which serve ballast water tanks terminate at least 4 inches above the deck and be closed by a tight fitting hinged cover making metal to metal contact with the hinge on the forward side. Positive means to secure these caps in the closed position shall be provided. No perforations or openings will be permitted throughout the length of a sounding pipe where fitted to oil tanks. Provision shall be made to prevent damage to the vessel's plating by the striking of the sounding rod.

**§ 55.10–70 Overboard discharges and shell connections.**

(a) (1) All inlets and discharges led through the vessel's sides shall be fitted with efficient and accessible means for preventing the accidental admission of water into the vessel in the event of fracture of such pipes.

(2) The number of scuppers, sanitary discharges, tank overflows, and other similar openings in vessel's sides shall be reduced to a minimum, either by making each discharge serve for as many as possible of the sanitary and other pipes, or in any other satisfactory manner.

(3) Where overboard discharges are led through the vessel's sides from spaces above the freeboard deck and are located not more than 18 inches below the freeboard deck and at least 24 inches above the deepest load line, the valves at the vessel's side as required by this section may be omitted.

(b) (1) Each separate overboard discharge led through the vessel's side from spaces below the freeboard deck, shall be provided with one automatic nonreturn valve fitted with a positive means of closing from above freeboard deck, or, alternatively, with two automatic nonreturn valves without positive means of closing, provided the upper valve is so located above the deepest load line as to be always accessible for examination under service conditions, and is of a type which is normally closed.

(2) Where a nonreturn valve with positive means of closing is fitted, the operating position above the freeboard deck shall always be readily accessible, and means shall be provided for indicating whether the valve is open or closed. Suitable arrangement shall be made to insure the valve not being closed by unauthorized persons and a notice shall be posted in a conspicuous place at the operating station to the effect that

the valve shall not be closed except as may be required in an emergency.

(c) All overflow pipes which discharge through the vessel's side shall be located as far above the deepest load line as practicable, and shall be provided with nonreturn valves located at the vessel's side. Where the overflows do not extend above the freeboard deck before discharging overboard, additional nonreturn valves shall be provided as required by paragraph (b) of this section, except that the two nonreturn valves shall always be used unless it is impractical to locate the upper valve in an accessible position, in which case the one nonreturn valve with positive means of closing will be acceptable.

(d) (1) Scuppers in the weather portions of decks shall be led overboard and scuppers in fully enclosed superstructures on the freeboard deck and lower decks shall be led to the bilges, unless they are led overboard and fitted with valves as required by paragraph (b) of this section. Where scuppers in partially enclosed superstructures lead overboard, they shall be fitted with nonreturn valves at the vessel's side; or, alternatively, they may be led to the bilges: *Provided*, That the scuppers are fitted with efficient and accessible means for closing in an emergency.

(2) Conditional upon the type and location of the inboard ends of sanitary and other similar discharges, the provisions of paragraph (b) of this section may be required as to discharges from spaces within enclosed superstructures.

(e) The inboard openings of ash and rubbish-chute discharges shall be fitted with efficient covers. If the inboard opening is located below the freeboard deck, the cover shall be watertight, and in addition, an automatic nonreturn valve shall be fitted in the chute in an easily accessible position above the deepest load line. Means shall be provided for securing both the cover and the valve when the chute is not in use. When ash ejectors or similar expelling devices located in the boilerroom have the inboard openings below the deepest load line, they shall be fitted with efficient means for preventing the accidental admission of water. The thickness of pipe for ash-ejector discharge shall be not less than that of extra strong pipe.

(f) Pump connections led through the vessel's sides below the freeboard deck shall be fitted with shutoff valves located as near the shell plating as practicable. The thickness of pipe for pump connections shall be not less than that of extra strong pipe.

(g) Where deck drains, soil lines, and sanitary drains discharge through the shell in way of cargo tanks on tank vessels, the valves required by this section shall be located outside the cargo tanks. The piping led through such tanks shall be fitted with expansion bends where required, and shall be of steel pipe having a wall thickness of not less than 5/8 inch, except that the use of suitable corrosion-resistant material of lesser thickness will be given special consideration by the Commandant. All pipe joints within the tanks shall be welded. Soil lines and sanitary drains which pass through cargo tanks shall be provided with non-return valves with positive means of closing or other suitable means for preventing the entrance of gases into living quarters.

(h) (1) Pipes terminating at the shell plating shall be fitted with bends or elbows between the outboard openings and the first rigid connection inboard. In no case shall such pipes be fitted in a direct line between the shell opening and the first inboard connection.

(2) Sea chests and overboard discharge fittings shall be of substantial construction and as short as possible.

(3) Sea chests shall be so located as to minimize the possibility of blanking off the suction.

(i) On new installations or replacements in vessels of 150 gross tons and over, malleable iron and non-ductile cast irons are not permitted for any connection to the shell plating below the freeboard deck nor shall such valves be secured to sea chests. Steel, bronze, or other approved ductile material shall be used. For this purpose, nodular cast iron, Grade 60–45–15, conforming to the requirements of Subpart 51.61 of Part 51 of this subchapter, may be used for shell connections below the freeboard deck and valves secured to sea chests. Lead or other heat sensitive materials shall not be used for pipes fitted outboard of shell valves in inlets or discharges, or in any other application where the deterioration of such pipes in the event of fire would give rise to danger of flooding.

(j) On passenger vessels where the bulkhead deck is higher than the freeboard deck, the requirements of this section shall be determined with respect to the bulkhead deck. For vessels not assigned load lines, such as certain inland vessels and barges, the weather deck shall be taken as the freeboard deck.

## Subpart 55.13—Refrigeration Systems

### § 55.13–1 Scope.

The regulations in this subpart apply to fixed refrigeration systems. The requirements shall not apply to small, portable self-contained units.

### § 55.13–5 Design pressure.

The pressure vessels, compressors, piping, and controls shall be designed for the minimum pressures given in table 55.13–5.

TABLE 55.13–5—REFRIGERANT DESIGN PRESSURES

| Refrigerant | Symbol | Design pressure | |
|---|---|---|---|
| | | High side (p. s. i.) | Low side (p. s. i.) |
| Ammonia | ($NH_3$) | 300 | 150 |
| Carbon dioxide | ($CO_2$) | 1,500 | 1,000 |
| Freon-11 | ($CCl_3F$) | 30 | [illegible] |
| Freon-12 | ($CCl_2F_2$) | 225 | 150 |
| Freon-21 | ($CHCl_2F$) | 70 | 40 |
| Freon-22 | ($CHClF_2$) | [1] 300 | [1] 150 |
| Freon-113 | ($C_2Cl_3F_3$) | [illegible] | 30 |
| Freon-114 | ($C_2Cl_2F_4$) | 50 | 50 |

[1] Permitted for watercooled installations only.

### § 55.13–10 Pressure vessels and piping.

(a) Each pressure vessel containing refrigerants, which may be isolated, shall be protected by a relief valve set to relieve at a pressure not exceeding the maximum allowable pressure. When a pressure vessel forms an integral part of a system having a relief valve, such vessel need not have an individual relief valve.

(b) Relief valves fitted on the high pressure side may discharge to the low pressure side before relieving to atmosphere. When relieving to atmosphere a relief valve shall be fitted in the atmospheric discharge connection from the receivers and condensers set to relieve at a pressure not greater than the maximum allowable pressure. A rupture disk may be fitted in series with the relief valve, provided the bursting pressure of the rupture disk is not in excess of the relief valve set pressure. Where a rupture disk is fitted on the downstream side of the relief valve, the relief valve shall be of the type not affected by back pressure.

(c) A relief valve shall be fitted on or near the compressor on the gas discharge side between the compressor and the first stop valve with the discharge therefrom led to the suction side.

(d) A check valve shall be fitted in the atmospheric discharge line if it is led through the side of the vessel below the freeboard deck, or a shutoff valve may be employed if it is locked in the open position.

(e) All piping materials shall be suitable for handling the primary refrigerant, brine, or fluid used, and shall be of such chemical and physical properties as to remain ductile at the lowest operating temperature.

### § 55.13–15 Tests.

(a) All pressure vessels, compressors, piping and direct expansion cooling coils shall be leak tested with gas after installation to their design pressures as required by § 55.13–5.

(b) No gas tests shall be made aboard ship higher than the design pressure of the part of the system being tested. The refrigerant in the system may be used for this test. If the refrigerant has been removed, oil pumped dry nitrogen or bone dry carbon dioxide with a detectable amount of the refrigerant added, should be used as a testing medium. (Carbon dioxide should not be used to leak test an ammonia system.) In no case should air, oxygen, any flammable gas or any flammable mixture of gases be used for testing.

## Subpart 55.16—Liquefied Petroleum Gases for Cooking and Heating

### § 55.16–1 Scope.

(a) Liquefied petroleum gas may be used for cooking and heating on all vessels subject to inspection by the Coast Guard, except passenger vessels, provided the installation complies with the requirements of this subpart.

(b) It is the intent of the regulations in this subpart to permit liquefied petroleum gas systems of the vapor with-

drawal type only. Cylinders designed to admit liquid gas into any other part of the system are prohibited.

(c) All component parts of the system, except cylinders, appliances, and low pressure tubing, shall be designed to withstand a pressure of 500 pounds per square inch without rupture.

**§ 55.16–5 Definition.**

(a) For the purpose of this subpart the term "liquefied petroleum gas" means any liquefied flammable gas which is composed predominantly of hydrocarbons or mixtures of hydrocarbons, such as propane, propylene, butane, butylene, or butadiene, and which has a Reid[1] vapor pressure exceeding 40 pounds per square inch absolute at 100 degrees F.

**§ 55.16–10 Approvals.**

(a) *Gas appliances.* (1) All gas-consuming appliances used for cooking and heating shall be of a type approved by the Commandant, and shall be tested and approved for liquefied petroleum gas service by the American Gas Association and shall bear the approval seal of the American Gas Association Testing Laboratories.

(2) Continuous-burning pilot flames are prohibited for use on gas appliances when installed below the weather deck.

(3) Printed instructions for proper installation, operation, and maintenance of each gas-consuming appliance shall be furnished by the manufacturer.

(b) *Cylinders.* (1) Cylinders in which liquefied petroleum gas is stored and handled shall be constructed, tested, marked, maintained and retested in accordance with the regulations of the Interstate Commerce Commission.

(2) All liquefied petroleum gas cylinders in service shall bear a test date marking indicating that they have been retested in accordance with the regulations of the Interstate Commerce Commission.

(3) Regardless of the date of the previous test, a cylinder shall be rejected for further service when it leaks; when it is weakened appreciably by corrosion, denting, bulging or other evidence of rough usage; when it has lost more than 5% of its tare weight; or when it has been involved in a fire.

(c) *Safety relief devices.* All safety relief devices, where required, shall be approved as to type, size, pressure setting, and location, by the Bureau of Explosives in conformance with the regulations of the Interstate Commerce Commission.

(d) *Valves, regulators and vaporizers.* All component parts of the system, other than cylinders and low pressure distribution tubing between regulators and appliances, shall be tested and approved by and bear the label of the Underwriters Laboratories, Inc., or other recognized testing laboratory.

(e) *Plan approval.* Drawings in triplicate, showing the location and installation of all piping, gas-consuming appliances, cylinders, and other component parts of the system shall be submitted for approval.

**§ 55.16–15 Valves and safety relief devices.**

(a) Each cylinder shall have a manually operated screw-down shutoff valve fitted with handwheel installed directly at the cylinder outlet.

(b) All cylinders shall be protected by one or more safety relief devices complying with the requirements of § 55.16–10 (a). The safety relief device shall be a shutoff valve with an integral spring-loaded safety relief valve and supplementary fusible plug, the latter designed to yield when the cylinder has been emptied of liquid gas by the relief valve under conditions of exposure to excessive heat.

(c) Cylinder valves and safety relief devices shall have direct communication with the vapor space of the cylinder.

(d) In addition to the cylinder valve, a multiple cylinder system shall be provided with a two-way positive shutoff manifold valve of the manually operated type. The manifold valve shall be so arranged that the replacement of empty cylinders can be made without shutting down the flow of gas in the system.

(e) A master packless shutoff valve controlling all burners simultaneously shall be installed at the manifold of all gas-consuming appliances.

**§ 55.16–16 Reducing regulators.**

(a) All systems shall be provided with a regulating device so adjusted as to release gas to the distribution tubing at a pressure not in excess of 18 inches water column, or approximately 10.5 ounces per square inch.

(b) The low pressure side of all regulators shall be protected against excessive pressure by means of a suitable relief valve which shall be integral with the regulator. The relief valve shall be set to start to discharge at a pressure not less than two times and not more than three times the delivery pressure.

(c) All reducing regulators shall be fitted with a pressure gage located on the high pressure side of the regulator.

**§ 55.16–17 Piping and fittings.**

(a) The piping between the cylinders and the appliances shall be seamless annealed copper tubing or such other seamless tubing as may be approved by the Commandant.

(b) All high pressure tubing between the cylinders and the regulators shall have a minimum wall thickness of 0.049 inch. All low pressure tubing between the regulator and appliances shall have a minimum wall thickness of 0.032 inch.

(c) Tubing connecting fittings shall be of the flared type; or connections may be soldered or brazed with material having a melting point in excess of 1,000 degrees F.

**§ 55.16–18 Installation.**

(a) *Cylinders, regulating and safety equipment.* (1) Cylinders, regulating and safety equipment shall be installed in a substantially constructed and firmly fixed metal enclosure located on or above the weather deck. The cylinder enclosure shall have access from the weather deck only. The enclosure shall be provided with top and bottom ventilation consisting of a fresh air inlet pipe and an exhaust pipe both entering through the top of the cylinder housing. The enclosure shall be so constructed that when the access opening is closed, no gas can escape except through the ventilation system.

(2) Cylinders, regulating and safety devices shall be securely fastened and supported within the metal enclosure. The cylinders and high pressure equipment shall be so mounted as to be readily accessible and capable of easy removal for refilling and inspection. The stowage of high pressure equipment in the housing shall be such that the cylinder valves can be readily operated and the pressure gage dial be easily visible. Where possible, cylinders shall be mounted in an upright position.

(3) Stowage of unconnected spare cylinders, filled or empty, shall comply with the requirements for cylinders.

(4) All valves, manifolds and regulators shall be securely mounted in locations readily accessible for inspection, maintenance and testing, and shall be adequately protected.

(5) Discharge of the safety relief valves shall be vented away from the cylinder, and insofar as practicable, upward into the open atmosphere, but in all cases so as to prevent impingement of the escaping gas onto a cylinder.

(b) *Piping.* (1) All piping shall be installed so as to provide minimum interior runs and adequate flexibility. The piping at the cylinder outlets shall be fitted with flexible metallic connections to minimize the effect of cylinder movement on the outlet piping.

(2) Distribution lines shall be protected from physical damage and be readily accessible for inspection. Lines shall be substantially secured against vibration by means of soft nonferrous metal clips without sharp edges in contact with the tubing. When passing through decks or bulkheads, the lines shall be protected by ferrules of nonabrasive material. The distribution lines shall be continuous length of tubes from the regulator to the shutoff valve at the appliance manifold.

(c) *Gas-consuming appliances.* All gas-consuming appliances shall be permanently and securely fastened in place.

(d) *Electrical.* No electrical connections shall be made within the cylinder housing.

**§ 55.16–19 Tests.**

(a) *Installation.* (1) After installation, the distribution tubing shall be tested prior to its connection to the regulator and appliance by an air pressure of not less than 5 pounds per square inch.

(2) After satisfactory completion of the tests prescribed in subparagraph (1) of this paragraph, the distribution tubing shall be connected to the regulator and appliance and the entire system subjected to a leak test as required by § 55.16–30(j).

[1] As determined by the American Society for Testing Materials Standard D–323 (most recent revision)—Method of Test for Vapor Pressure of Petroleum Products (Reid Method).

(b) *Periodic.* Leak tests as required by § 55.16–30 (j) shall be conducted at least once each month and at each regular annual or biennial inspection. The tests required at monthly intervals shall be conducted by a licensed officer of the vessel or qualified personnel acceptable to the Officer in Charge, Marine Inspection. The owner, master, or person in charge of the vessel shall keep records of such tests showing the dates when performed and the name(s) of the person(s) and/or company conducting the tests. Such records shall be made available to the inspector upon request and shall be kept for the period of validity of the vessel's current certificate of inspection. Where practicable, these records should be kept in or with the vessel's logbook.

**§ 55.16–20 Ventilation of compartments containing gas-consuming appliances.**

(a) Compartments containing gas-consuming appliances which are located above the weather neck shall be fitted with at least two natural ventilator ducts led from atmosphere and extending to the floor level and to the overhead of the compartment. Mechanical ventilation may be used provided the motor is outside of the compartment.

(b) Where compartments in which gas-consuming appliances are located entirely below the weather deck, mechanical or power ventilation shall be provided with sufficient capacity to effect a change of air at least once every 6 minutes.

**§ 55.16–25 Odorization.**

(a) All liquefied petroleum gases shall be effectively odorized by an agent of such character as to indicate positively, by a distinctive odor, the presence of gas down to concentration in air of not over one-fifth the lower limit of combustibility.

**§ 55.16–30 Operating instructions.**

(a) Before opening a cylinder valve, the outlet of the cylinder shall be connected tightly to the system; and in the case where only a single cylinder is used in the system, all appliance valves and pilots shall be shut off before the cylinder valve is opened.

(b) Before opening cylinder valve after connecting it to system, the cylinder shall be securely fastened in place.

(c) When cylinders are not in use their outlet valves shall be kept closed.

(d) Cylinders when exhausted shall have their outlet valves closed.

(e) Nothing shall be stored in the metal enclosure except liquefied petroleum gas cylinders and permanently fastened parts of the system.

(f) Valve protecting caps, if provided, shall be firmly fixed in place on all cylinders not attached to the system. Caps for cylinders in use may remain in the cylinder enclosure if rigidly fastened thereto.

(g) The opening to the cylinder enclosure shall be closed at all times except when access is required to change cylinders or maintain equipment.

(h) Close master valve whenever gas-consuming appliance is not in use.

(i) No smoking is permitted in the vicinity of the cylinder enclosure when access to enclosure is open.

(j) Test system for leakage in accordance with the following procedure: With appliance valve closed, the master shut-off valve on the appliance open, and with one cylinder valve open, note pressure in the gage. Close cylinder valve. The pressure should remain constant for at least 10 minutes. If the pressure drops, locate leakage by application of liquid detergent or soapy water solution at all connections. Never use flame to check for leaks. Repeat test for each cylinder in a multicylinder system.

(k) Report any presence of gas odor to ----------

**§ 55.16–35 Markings.**

(a) The outside of the cylinder enclosure housing liquefied petroleum gas cylinders, valves and regulators shall be marked as follows:

Liquefied Petroleum Gas
Keep Open Fires Away.
Operating Instructions
Inside and In----

(b) A durable and permanently legible instruction sign covering safe operation and maintenance of the gas-consuming appliance shall be installed adjacent to the appliance.

(c) "Operating Instructions" as listed in § 55.16–30 shall be framed under glass, or other equivalent, clear, transparent material, in plainly visible locations on the outside of the metal enclosure and near the most frequently used gas-consuming appliance, so they may be easily read.

## Subpart 55.17—Hydraulic Systems

**§ 55.17–1 Scope.**

(a) This part contains requirements for hydraulic power transmission systems and appurtenances.

(b) Hydraulic machinery may be accepted for installation on vessels subject to inspection provided the design material and fabrication comply with the applicable requirements of the American Bureau of Shipping or other recognized classification society.

**§ 55.17–10 Design requirements.**

(a) The pressure vessels, tubing, pipes and fittings shall be designed for the maximum operating pressure or not less than the relief valve setting.

(b) The system shall be so designed that proper functioning of any unit shall not be affected by the back pressure in the system. The design shall be such that malfunctioning of any unit in the system will not render any other connected or emergency system inoperative because of back pressure.

**§ 55.17–15 Hydraulic fluid.**

(a) The fluid used in hydraulic power transmission systems shall have a flash-point of not less than 200° F. for pressures below 150 pounds per square inch and 315° F. for pressures 150 pounds per square inch and above, as determined by ASTM Designation D–92–57, Cleveland "Open Cup" test method.

(b) The chemical and physical properties of the hydraulic fluid shall be suitable for use with any materials in the system or components thereof.

(c) The hydraulic fluid shall be suitable for operation of the hydraulic system through the entire temperature range to which it may be subjected in service.

**§ 55.17–20 Tubing and pipes.**

(a) Materials used in the manufacture of pressure vessels, tubing, pipe, flanges, fittings or bolting shall conform to the requirements of Part 51 subject to the limitations shown in Tables 52.05–10(a) and 55.07–1(b). SAE designated materials shall be evaluated on the basis of chemical and physical properties.

(b) Design pressures and thicknesses shall be calculated as required by § 55.07–5(a)(1), except that the allowance for threading, grooving and/or corrosion may be omitted when flared or flareless type tube fittings are used.

(c) All tubing and pipe materials shall be suitable for handling the hydraulic fluid used and shall be of such chemical and physical properties as to remain ductile at the lowest operating temperature.

**§ 55.17–25 Hydraulic hose and fittings.**

(a) Hose and fittings shall meet the requirements of § 55.07–1. Hose shall be complete with factory-assembled end fittings requiring no further adjustment, of the fittings on the hose, except that reusable type fittings may be used provided they are of the nipple and socket type in which the hose is securely attached to the fitting by compression of the hose.

(b) Hose assemblies may be installed between two points of relative motion but shall not be subjected to torsional deflection (twisting) under any conditions of operation and shall be limited, in general, to short lengths required for flexibility. Special consideration may be given to the use of longer lengths of flexible hose where required for proper operation of machinery and components in the hydraulic system.

(c) Hose assemblies shall be designed for a bursting pressure of not less than four times the maximum allowable pressure.

(d) Sharp bends in hose shall be avoided.

**§ 55.17–30 Accumulators.**

(a) An accumulator is an unfired pressure vessel in which energy is stored under high pressure in the form of a gas or a gas and hydraulic fluid. Accumulators shall be constructed under the provisions of Part 54 of this subchapter.

(b) If the accumulator is of the gas and fluid type, suitable separators shall be provided between the two media, if their mixture would be dangerous, or would result in contamination of the hydraulic fluid and loss of gas through absorption.

(c) Each accumulator which may be isolated, shall be protected on the gas

and fluid sides by relief valves, set to relieve at pressures not exceeding the maximum allowable pressures. When an accumulator forms an integral part of systems having relief valves, the accumulator need not have individual relief valves.

**§ 55.17–35 Hydraulic cylinders.**

(a) Hydraulic cylinders consisting of a container and a movable piston with a rod extending through the containment vessel are considered to be auxiliary machinery coming within the scope of Part 57 of this subchapter.

(b) Hydraulic cylinders shall be designed for a bursting pressure of not less than 4 times the maximum allowable pressure and shall meet the applicable standards established by the American Bureau of Shipping or other recognized classification society.

**§ 55.17–40 Tests.**

(a) Hydraulic systems and components thereof shall be tested, marked and retested as required by Part 61 of this subchapter.

(b) Hydraulic systems shall be purged with an inert gas or with the working fluid and all trapped air bled from the system prior to any shipboard testing. In no case shall air, oxygen, any flammable gas, or any flammable mixture of gases be used for testing.

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## PART 56—ARC WELDING, GAS WELDING, AND BRAZING

**Subpart 56.01—Arc Welding and Gas Welding**

Sec.


56.01–1 Scope.
56.01–5 Definitions.
56.01–8 Plan approval.
56.01–10 Welder qualification.
56.01–15 Welding procedure qualification.
56.01–20 Arc welding electrodes.
56.01–25 Classes of arc-welded pressure vessels.
56.01–30 Welded joint efficiencies.
56.01–40 Material.
56.01–45 Calculations.
56.01–50 Detail requirements.
56.01–55 Joints.
56.01–57 Unreinforced holes in welded joints.
56.01–65 Seal welding and tack welding.
56.01–70 Preheating and stress relieving.
56.01–75 Distortion.
56.01–80 Welded piping.
56.01–85 Welded pipe fittings.


**Subpart 56.05—Tests and Inspection**


56.05–1 Test plates.
56.05–3 Qualification of radiographic test procedure.
56.05–5 Nondestructive tests.
56.05–6 Spot examination of welded joints.


**Subpart 56.10—Brazing**


56.10–1 Definition.
56.10–5 Detail requirements.
56.10–10 Materials.
56.10–15 Thickness and maximum allowable pressure.
56.10–20 Types of joints.
56.10–25 Pipe joints.
56.10–30 Silver brazing.


AUTHORITY: The provisions of this Part 56 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426–4431, as amended, 4433, as amended, 4434, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404–409, 411, 412, 435, 481, 489, 366, 395, 363, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857.

### Subpart 56.01—Arc Welding and Gas Welding

**§ 56.01–1 Scope.**

This part contains detail requirements covering the welded fabrication of machinery appurtenances and pressure-containing parts such as boilers, boiler furnaces, unfired pressure vessels, piping, valves, pipe fittings, etc., subject to inspection by the Coast Guard.

**§ 56.01–5 Definitions.**

(a) *Welding terms.* All references in this part or on plans, specifications, etc., to welding or allied processes shall be understood to be those of the American Welding Society's A3.0–49 "Welding Terms and Their Definitions."[1]

(b) *Fabrication.* The term "fabrication" as used in this part refers to the assembly of machinery and appurtenances by welding, cutting and other processes allied to welding.

(c) *Welding procedure.* The term "welding procedure" refers to the detailed methods and practices including joint welding procedures involved in the production of a weldment.

(d) *Welding process.* Welding process is a metal-joining process wherein coalescence is produced by heating to suitable temperatures with or without the application of pressure, and with or without the use of filler metal.

**§ 56.01–8 Plan approval.**

Plans shall clearly show all essential fabrication details. Welded or brazed joints shall be clearly and completely detailed on the plans, or standard welding symbols as specified in the American Welding Society's Standard A2.0–47, "Standard Welding Symbols"[1] shall be used to designate the type and size of welds.

**§ 56.01–10 Welder qualification.**

(a) *Qualification provisions.* (1) Each welder, prior to performing any production welding in fabricating equipment listed in § 56.01–1, shall demonstrate his ability to produce sound welded joints with the welding process to be used in production. This shall consist of welding the applicable test joints shown in table 56.01–10(j) to the soundness requirements specified in this section for each type of test, except welders may be considered qualified under the alternate provisions of subparagraph (2) of this paragraph. Welder qualification tests are not required for operators of machine-welding equipment.

(2) (i) Welders who have been qualified by the Bureau of Ships of the Navy Department, or the American Bureau of Shipping, shall be considered qualified within the limits covered by the qualification tests passed.

(ii) The omission of qualification tests of metal arc welders working on assemblies may be authorized by the Officer in Charge, Marine Inspection provided the initial production welds are radiographically examined and found satisfactory to the standards prescribed in Radiographic Standards for Welder Qualification Test, CG 115–1, a copy of which is on file with each Officer in Charge, Marine Inspection. The welder shall be considered qualified for the process, equipment and materials, and in the position of the production welding.

(iii) Qualification tests of welders may be omitted for welders who weld satisfactory procedure qualification test assemblies as required by the Commandant. The welder shall be considered qualified for the process, equipment and materials, and in the position for which the procedure is qualified.

(b) *Process.* The welding processes requiring qualification of welders shall be as follows:

(1) Manual, shielded metal arc.
(2) Semi-automatic, inert-gas (consumable electrode) metal arc.
(3) Semi-automatic submerged arc.
(4) Manual, inert-gas (tungsten electrode) metal arc.
(5) Manual carbon arc.
(6) Manual gas welding.
(7) Manual torch brazing.

(c) *Process qualification limitation.* Welders qualified for a given process with a specific type of electrode or welding rod shall be considered qualified for welding by that process with any other electrode or rod of similar type as provided for in table 56.01–10 (p).

(d) *Fabricator's responsibility.* The fabricator shall direct and supervise the testing of welders and shall bear the expense of conducting the tests. When welders are to be qualified by the Coast Guard, the fabricator shall notify the marine inspector and arrange a suitable time and place for conducting the tests so the marine inspector may be present.

(e) *Requalification requirements.* A welder shall be requalified whenever one or more of the changes listed below are made and is to be used in production:

(1) When the filler metal is changed to a filler metal having a different M number in table 56.01–10 (p) or to a filler metal not included, except that qualification under M2 shall qualify a welder for M1.

(2) When the welding position is changed to positions other than those previously qualified.

(3) When the backing strip in arc-welding single welded butt joints is omitted.

(4) When a backing strip in gas welding is added.

(5) Where there is a change in welding processes.

[1] These standards included in American Welding Society Handbook.

(f) *Qualification duration.* The welder's qualification from tests passed as prescribed in this section shall remain in effect indefinitely unless:

(1) The welder does not use the process for which he was qualified for a period of three months or more; or

(2) The marine inspector believes there is reasonable doubt of the welder's ability. In such cases the welder shall not perform production welding until he passes the applicable qualification tests.

(g) *Retests.* If any of the welder's qualification test welds fail to meet the requirements specified in this section, he may be allowed a retest under the following conditions:

(1) A retest may be made which shall consist of two test welds of each type he failed, all of which shall meet the applicable requirements.

(h) *Test records.* Qualification test records of each welder together with identification data, shall be maintained in typewritten form or in ink by the fabricator on cards similar to that shown in Figure 56.01–10 (h). Upon request, duplicate record cards shall be furnished the marine inspector or to any of the participating agencies.

(i) *Transferral of qualification.* The qualification of a welder shall not be transferred from one company's organization to another company's organization. The welder's qualification record may be transferred from one plant to another plant of the same company if authorized by the Officer(s) in Charge, Marine Inspection, involved.

(j) *Qualification test.* The welder qualification tests shall consist of welding the applicable test assemblies shown in Table 56.01–10 (j).

WELDER'S IDENTIFICATION

| Date of birth (Month) (Day) (Year) | Place of birth (City) (State) (Country) | Check No. |
|---|---|---|
| | | |

| Welder's Employment Record | | |
|---|---|---|
| Process | From— | To— |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
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| | | |
| | | |
| | | |
| | | |
| | | |

Welder's symbol

Photograph or thumb print

Date taken.....

Check:
Right Hand ☐
Left Hand ☐

(Welder's signature)

| Name (Last) (First) (Middle) | Employed by— | Location of plant |
|---|---|---|
| | | |

| Process | Test No. | Base metal | Position | Filler metal | | Date of test | Group limitations | Type of test* | Signature of inspector | Agency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Type | Size | | | | | |
| | | | | | | | | | | |
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*P=Physical tests. R=Radiographic test.

FIGURE 56.01–10 (h)—Welder's identification and record of qualification tests.

TABLE 56.01–10 (j)—WELDER QUALIFICATION TESTS AND APPLICABLE CONDITIONS

| Construction and material size | Position in which welding shall be done [1] | | |
|---|---|---|---|
| | Flat, vertical, horizontal and overhead: grooves and fillets. | Flat and vertical: grooves and fillets, horizontal fillets. | Flat: grooves and fillets, horizontal fillets |
| On material of limited thickness (¾ inch or less).[2 3 4] | Test No. 1 in vertical and overhead positions. Figure 56.01–10 (j3). | Test No. 1 in vertical position. Figure 56.01–10 (j3). | Test No. 1 in flat position Figure 56.01–10 (j3). |
| On material of unlimited thickness.[4] | Test No. 2 in vertical and overhead positions. Figure 56.01–10 (j4). | Test No. 2 in vertical position. Figure 56.01–10 (j4). | Test No. 2 in flat position. Figure 56.01–10 (j4). |
| On pipe joints ¾ inch or less thick.[5 6 7] | Test No. 3 in horizontal and vertical fixed positions. Figure 56.01–10 (j5). | | Test No. 3 in horizontal rolled position. Figure 56.01–10 (j5). |
| On pipe joints over ¾ inch thick.[7 6] | Test No. 4 in horizontal and vertical fixed positions. Figure 56.01–10 (j5). | | Test No. 4 in horizontal rolled position. Figure 56.01–10 (j5). |
| For welders doing only tack- or fillet welding. | Test No. 5 in vertical and overhead fillet positions. Figure 56.01–10 (j7). | Test No. 5 in vertical and horizontal fillet positions. Figure 56.01–10 (j7). | Test No. 5 in horizontal fillet position. Figure 56.01–10 (j7). |
| For torch brazed piping [8]..... | Test No. 6 in horizontal and vertical fixed positions. Figure 56.01–10 (j8). | | |
| For torch brazing other than piping. | Test No. 7 in vertical and overhead fixed positions. Figure 56.01–10 (j9). | | |

[1] In special cases when welding is to be done in positions other than those shown in figure 56.01–10 (j2) the welder qualification test plate may be made in the position in which welding will be done with the limitation that the qualification shall be valid only for the actual position tested. An angular tolerance of plus or minus 15° shall apply.

[2] Where the maximum thickness of material on which a welder may work throughout the period governed by a test is indeterminate, the marine inspector may, if desired, require the welder to qualify under unlimited thickness requirements.

[3] Where the maximum thickness of material to be welded throughout the period governed by the test is less than ⅝ inch, the fabricator may, with the permission of the marine inspector, use the following modification of test number 1: The thickness of material shall be the maximum to be welded in production but shall not be less than 5/16 inch. The root opening shall not be more than one nominal diameter of the filler metal to be used. The backing strip thickness shall be not less than 5/32 inch.

[4] Welders qualified under the requirements of test number 1 in the flat position shall be considered qualified to weld piping ¾ inch or less in thickness in the horizontal rolled position and longitudinal pipe joints ¾ inch or less in thickness in the flat position. Welders qualified by test number 1 in the vertical position shall be considered qualified to weld piping ¾ inch or less in thickness in the horizontal fixed position from the horizontal axis up.

[5] Welders qualified under the requirements of test number 2 in the flat position shall be considered qualified to weld piping over ¾ inch in thickness in the horizontal rolled position and longitudinal pipe joints over ¾ inch in thickness in the flat position. Welders qualified by test number 2 in the vertical position shall be considered qualified to weld piping over ¾ inch in thickness in the horizontal fixed position from the horizontal axis up.

[6] Welders qualified under the requirements of test number 3 shall be considered qualified to make welds governed by test number 1 for the positions tested under test number 3.

[7] Welders qualified under the requirements of test number 4 shall be considered qualified to make welds governed by tests numbers 1, 2, and 3 for the positions tested under test number 4.

[8] Where the welder is to be qualified for welding or torch brazing of piping onboard ship the space restrictions shown in connection with tests numbers 3, 4, and 6 shall be used.

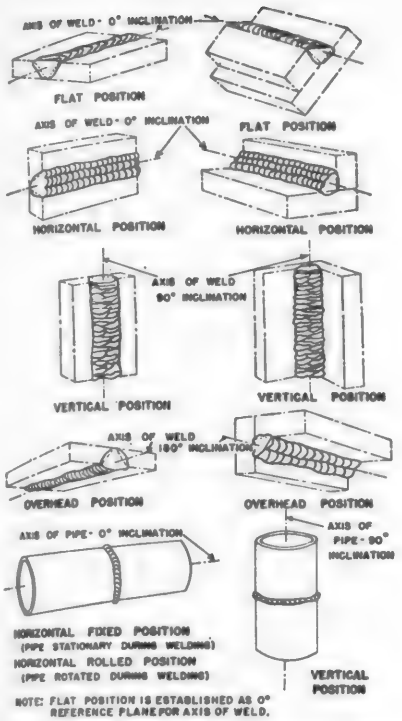

AXIS OF WELD - 0° INCLINATION
FLAT POSITION
FLAT POSITION
AXIS OF WELD - 0° INCLINATION
HORIZONTAL POSITION
HORIZONTAL POSITION
AXIS OF WELD 90° INCLINATION
VERTICAL POSITION
VERTICAL POSITION
AXIS OF WELD 180° INCLINATION
OVERHEAD POSITION
OVERHEAD POSITION
AXIS OF PIPE - 0° INCLINATION
AXIS OF PIPE - 90° INCLINATION
HORIZONTAL FIXED POSITION (PIPE STATIONARY DURING WELDING)
HORIZONTAL ROLLED POSITION (PIPE ROTATED DURING WELDING)
VERTICAL POSITION
NOTE: FLAT POSITION IS ESTABLISHED AS 0° REFERENCE PLANE FOR AXIS OF WELD.

FIGURE 56.01-10 (j2)—Positions of welding.

(k) *Test assembly markings.* Qualification test assemblies and all specimens removed therefrom shall be stamped or otherwise indelibly marked with the welder's identification number or symbol, the official stamp of the U. S. Coast Guard, and the marine inspector's initials or other identifying markings to establish the welding position and type of specimen. The test assembly markings shall be so located that they will not be removed by machining.

(l) *Requirements for test numbers 1, 2, 3, and 4.* (1) Specimens cut from the test plates shall be bent in a bending jig having the exact profile illustrated by figure 56.01-10 (j6). Specimens for qualification test number 1 modified for thinner material shall be bent in a jig having a contour proportional to the thickness of the test plates involved as shown in figure 56.01-10 (j6). Root bend specimens shall be bent with the root of the weld in tension; face bend specimens with the face in tension, and side bend specimens with that side, which is suspected of being the worst of the two, in tension.

(2) Specimens shall be bent until they conform to the contour of the female member of the jig, and until a 1/32-inch wire cannot be placed between the specimen and any point on the curvature of the male member of the jig. Any specimen in which a crack or opening exists before bending, or which results from the bending, exceeding 1/8 inch measured in any direction, shall be rejected. No elongation data are required.

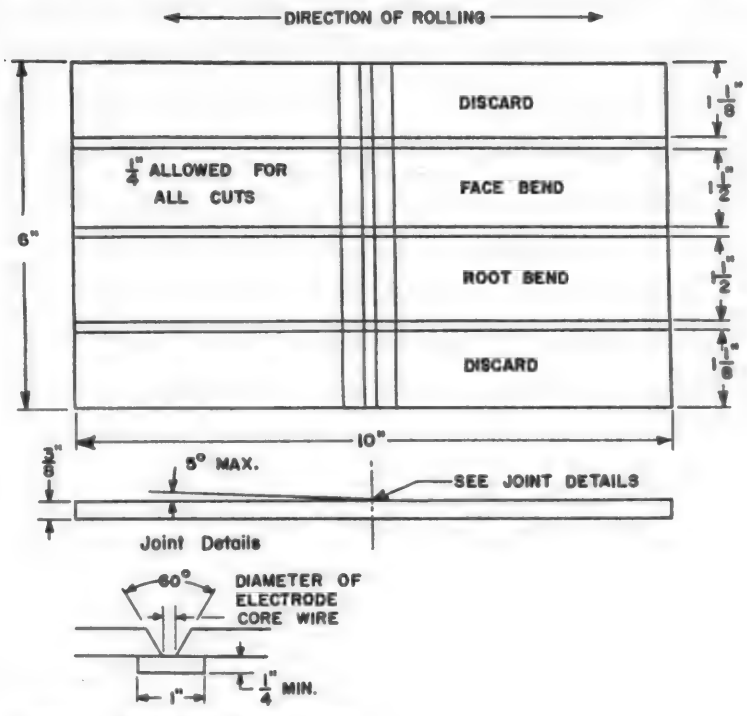


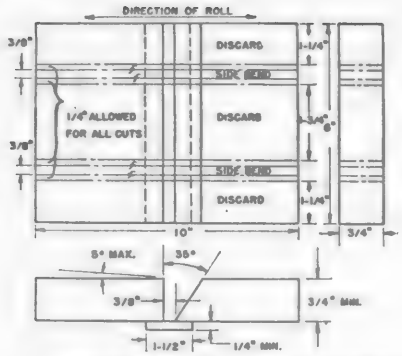

FIGURE 56.01-10 (j3)—Qualification test No. 1.

1. Weld shall be made with the maximum size electrode or welding rod suitable for the position and thickness of test plate.
2. Backing strap shall be contiguous with plates.
3. Joints welded in vertical position shall be welded upwards.
4. Welding shall be done from one side only.
5. Reinforcement and/or backing strap shall be machined flush. Undercutting shall not be removed.
6. Specimens may be machined or oxygen cut from plate.
7. Edges of specimens may be broken to a maximum radius of T/6.

(3) In lieu of tests as prescribed above, welders may be qualified by radiographic examination of butt joints for qualification tests numbers 1, 2, 3, and 4. Satisfactory passing of tests shall be determined from radiographs which show penetrameter and which show deposited weld metal free from slag entrapment, weld or fusion zone cracking, and does not contain porosity in excess of that shown in the applicable group of Radiographic Standards for Welder Qualification Test, CG-115-1, a copy of which is on file with each Officer in Charge, Marine Inspection. The radiographs of the test plates shall indicate that the weld(s) are acceptable for group 1 or 2 covering the fabrication classification for which the welder is being qualified as specified in table 56.01-10 (l) (3).

TABLE 56.01-10 (l) (3)—WELDER RADIOGRAPHIC QUALIFICATION TESTS

| Group | Classification |
|---|---|
| 1 | Class I piping. |
| 1 | Class I and class II welded pressure vessels. |
| 2 | Class II piping. |
| 2 | Class III welded pressure vessels. |




1. Welds shall be made with the maximum size electrode or welding rod suitable for the position and thickness of test plate.
2. Backing strap shall be contiguous with plates.
3. Joints welded in the vertical position shall be welded upwards.
4. Welding shall be done from one side only.
5. Machine reinforcement and backing strap flush. Do not remove any undercutting.
6. Specimens may be machined or oxygen cut from plate.
7. Break edges of specimens to a radius of T/6 maximum.

FIGURE 56.01-10(j4)—Qualification test No. 2.

(m) *Test number 5.* Fillet weld specimens shall comply with the following requirements:

(1) Welds shall be of the specified size and shall be within the applicable convexity or concavity limits of the gage.

(2) Base metal shall be free from excessive undercutting.

(3) Surface of welds shall be free of cracks, porosity, overlap and roughness.

(4) Fractured surfaces of fillet welds shall be free from cracks, and the sum of lengths of slag inclusions, gas pockets, worm holes, and sections of incomplete fusion that are present shall not exceed 1½ inches per 12 inches of weld.

(n) *Test number 6.* The torch brazed assembly shall comply with the following requirements:

(1) Exterior examination of the joint shall show a complete ring of filler metal between the tube and the outer ends of the fittings. Surfaces of the specimens shall be free of globules of filler metal. Fillets shall be concave and of minimum practicable dimension.

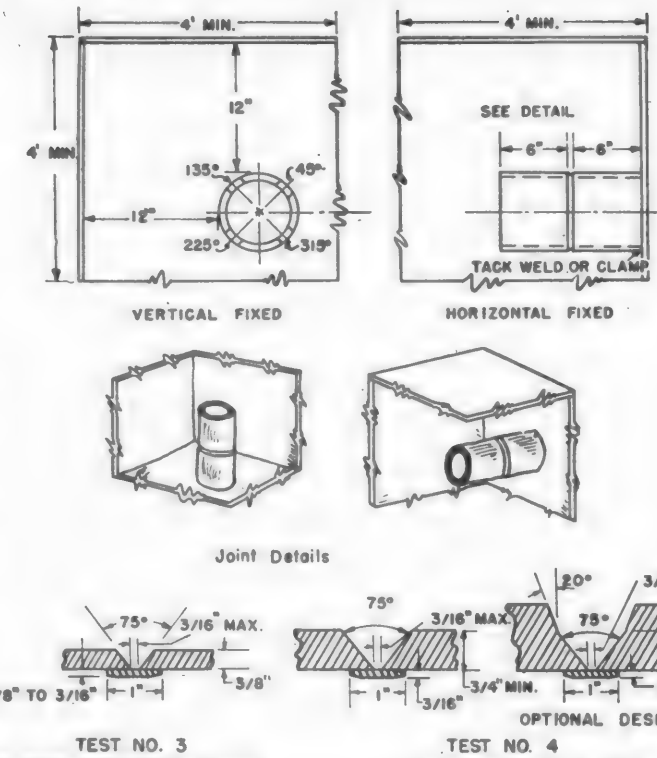
(2) The specimens shall be cut as shown in figure 56.01-10 (j8). Visual examination of the joints shall show complete penetration of the filler metal throughout at least 75 percent of the circumference of the fittings. Penetration is defined as follows: The presence or at least a metallic stain of filler metal at the fitting end of the tubing. The stain resulting from the penetration of the flux shall not be considered as penetration. The metallic stain is differentiated from the flux by its color which is grayish white. The flux stain is glossy in appearance.

(o) *Test number 7.* Specimens shall comply with the following requirements:

(1) Exterior examination of the joint shall show a complete line of filler metal at each edge of the joint. Surfaces of the specimen shall be free of globules of filler metal. Fillets shall be concave and of minimum practicable dimension.

(2) After visual examination specimens shall be fractured by peel test as shown in figure 56.01-10 (j10). Visual examination of the faying surface of the joint shall show at least 75 percent penetration of the filler metal throughout the joint. Specimens which do not fracture by peel test shall be acceptable if failure occurs in the base metal away from the joint.

(p) *Filler metal.* The grouping of electrodes and welding rods together with applicable specifications shall be as indicated in table 56.01-10 (p). The number grouping of electrodes and welding rods shown is based essentially on their usability characteristics which fundamentally determine the ability of a welder to make acceptable welds with a given electrode.




TEST 3A - WHERE MAXIMUM THICKNESS TO BE WELDED IS LESS THAN 3/8" WALL THICKNESS OF PIPE SHALL BE MAXIMUM TO BE WELDED BUT NOT LESS THAN 3/16"

SPECIMENS -
TEST 3 - FACE BENDS FROM 45° AND 225° POSITIONS
ROOT BENDS FROM 135° AND 315° POSITIONS
TEST 3A - MACRO SPECIMENS FROM 45°, 135°, 225°, AND 315° POSITIONS
TEST 4 - SIDE BENDS FROM 45°, 135°, 225°, AND 315° POSITIONS

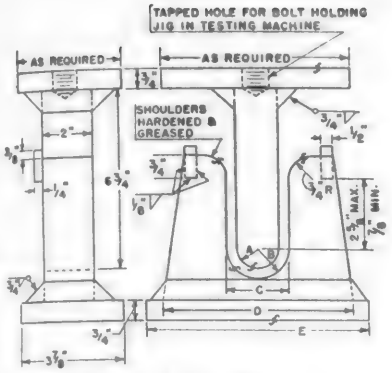
1. Space restrictions shown may be omitted when welders are to weld piping only in the shop.
2. Nominal pipe size shall be 5 inches or larger.
3. Weld shall be made with the maximum size electrode or welding rod suitable for the position and thickness of test plate.
4. Welding shall be from one side only.
5. Mark top and front of pipe to insure location of specimens.
6. Machine reinforcement and backing ring flush-undercutting shall not be removed.
7. Specimens may be machined or oxygen cut from pipe.
8. Edges of specimens shall be broken to a radius of T/6 maximum.

FIGURE 56.01-10 (j5)—Qualification tests Nos. 3 and 4.

### § 56.01-15 Welding procedure qualification.

(a) Fabricators desiring to use the submerged arc welding process, or a combination of submerged arc and manual welding processes, or any welding process requiring procedure qualification tests as prescribed by the regulations in this subchapter, shall conduct a procedure qualification test to insure that they have proper equipment, trained personnel, and are using correct procedure to produce acceptable welds.

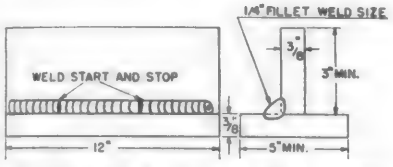
(b) The deposited weld metal may be laid in single or multiple passes. The joint design, amperage, voltage, speed of welding, size of welding wire, filler metal or electrode, and grade of melt or flux or type of inert gas, in general should be in accordance with the recommendations of the welding equipment manufacturer.




HARDENED ROLLS MAY BE USED ON SHOULDERS IF DESIRED

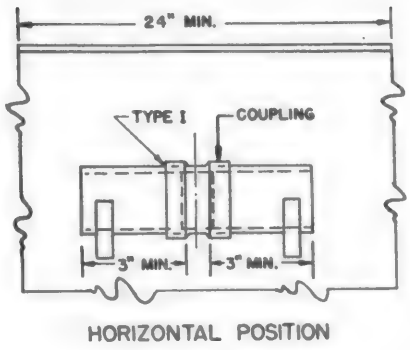
| SPECIMEN MATERIAL | SPECIMEN THICKNESS | DIMENSIONS A | B | C | D | E |
|---|---|---|---|---|---|---|
| BASE METALS OTHER THAN ALUMINUM | 3/8" | 3/4" | 1-3/16" | 2-3/8" | 7-1/2 | 8 |
| | 1" | 2T | 3T+1/16 | 6T+1/8" | 20T | 24T |
| ALUMINUM | 3/8" | 1-1/8" | 1-9/16" | 3-1/8" | 8-1/4" | 9-3/4" |
| | 1" | 3T | 4T+1/16 | 8T+1/8" | 22T | 26T |

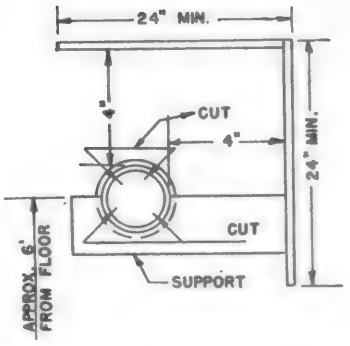
FIGURE 56.01-10 (j6)—Jig for guided bend test.




1. Weld shall be made with the maximum size of electrode suitable for the position and thickness of test plate.
2. Weld size specified is for single pass weld only.
3. Joints welded in the vertical position of welding shall be welded upwards.
4. Base plate and standing web shall be straight and in intimate contact throughout its length and securely tacked at ends before fillet weld is made.
5. The test assembly may be machined or oxygen cut into sections approximately 6 inches long to facilitate testing.

FIGURE 56.01-10 (j7)—Qualification test No. 5.




1. PIPE SIZES SHALL BE 2" MIN.
2. SPACE RESTRICTIONS SHOWN MAY BE OMITTED WHERE PIPING IS TO BE BRAZED ONLY IN THE SHOP.
3. FOR QUALIFICATION FOR BRAZING ON BOARD SHIP- BRAZE ONE COMPLETE COUPLING ASSEMBLY EACH IN HORIZONTAL AND VERTICAL FIXED POSITIONS. FOR QUALIFICATION FOR BRAZING IN SHOP-BRAZE ONE COUPLING ASSEMBLY WITH ONE JOINT IN HORIZONTAL (TYPE I) AND ONE IN VERTICAL OVERHEAD (TYPE II) POSITION.
4. SAW CUT PIPE AND COUPLING AT POINTS INDICATED FOR VISUAL AND MACRO EXAMINATION OF BRAZED JOINT.

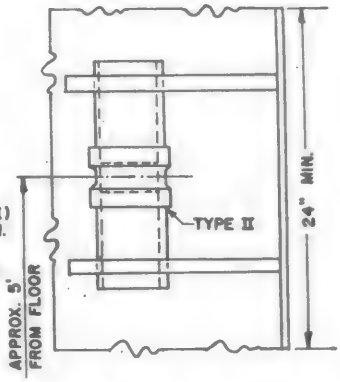



FIGURE 56.01-10 (j8)—Qualification test No. 6.

TABLE 56.01-10 (p)—GROUPING OF ELECTRODE AND WELDING RODS

| Type of weld deposit | | Applicable specification | Electrode Classification [1] [2] XX10 XX11 | XX12 XX13 | XX20 XX30 | XX15 XX16 | Welding rod classification |
|---|---|---|---|---|---|---|---|
| Mild steel | All types | A233-55 | M1 | M1 | M1 | M2 | |
| Carbon molybdenum | All types | A316-54T | M1 | | M1 | M2 | |
| Low alloy steel | All types | A316-54T | M1 | | | M2 | |
| Chrome molybdenum | 4 to 6 percent chrome-502 | A298-55T | | | | M2 | |
| High alloy martensitic | 11 to 14 chrome 410 | A298-55T | | | | M2 | |
| Chrome nickel | 308, 308 ELC 309, 309 cb, 309 Mo, 316,316 ELC, 318, 347. | A298-55T | | | | M3 | |
| Mild steel | All | A251-46T | | | | | M4 |

[1] Qualification of a welder for M2, automatically qualifies him for M1 but not vice versa. A welder qualifying with an electrode M3 and above is qualified only for that group.
[2] Covering and filler metal types not listed above shall require separate qualification.
[3] Base metal—Qualification of welding electrodes classes M1, M2, and M3 shall be performed on base metal of the comparable tensile strength and chemical analysis as the deposited weld where mechanical tests are used. Where qualification is by radiographic means, carbon steel may be used as the base material for qualification tests with M1 M2, and M3 electrode classes.

(c) Manufacturers desiring to secure process approval to fabricate pressure vessels, pipe and pressure-containing appurtenances by the use of any welding process requiring procedure qualification shall prepare test plates in the presence of a marine inspector who will stamp the plates with the official stamp of the Coast Guard. Specimens as required by Table 56.01-15(c) shall be machined from the test plate.

(d) The test plate material shall be of the type to be welded in production and of a thickness as shown in Table 56.01-15(c). The requirements specified in this section are applicable to materials having equivalent physical properties. If preheat is not used in production welding, it shall not be used in the preparation of the test plate. If it is desired to conduct a procedure qualification to weld metals of dissimilar physical properties, the fabricator shall so inform the Commandant who will designate the types and methods of tests.

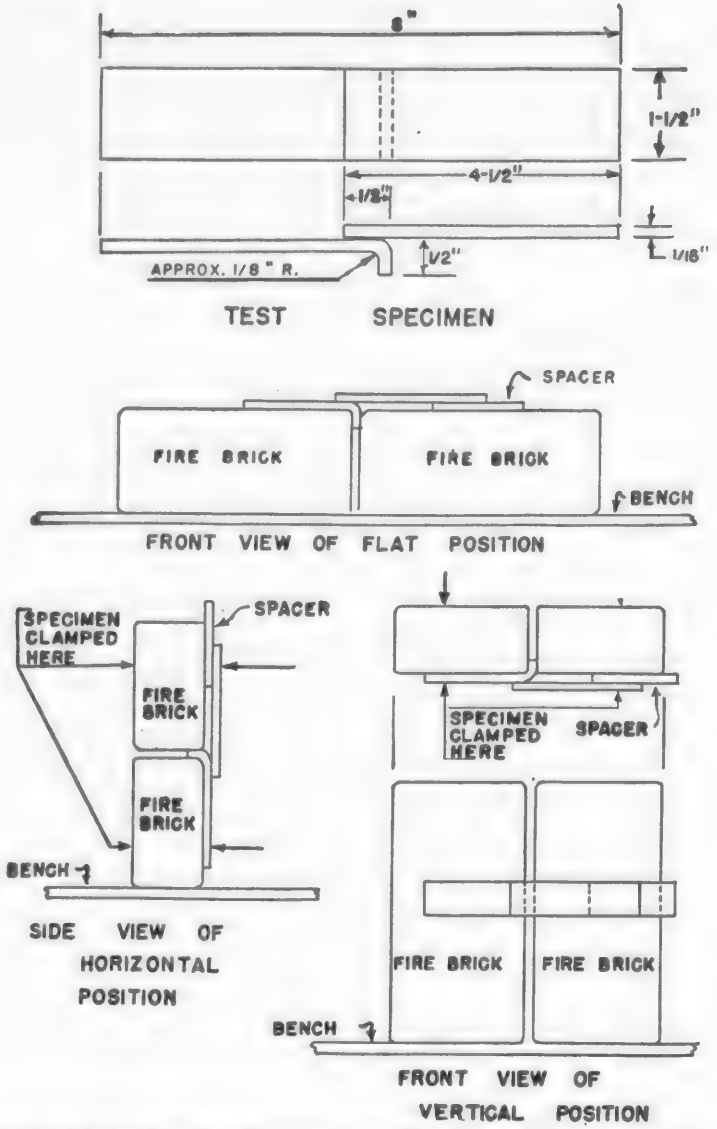
(e) Specimens may be tested by the fabricator or at a recognized testing laboratory. Specimens shall meet the requirements of § 56.05-1 and shall be tested in the presence of an inspector. One retest will be permitted for each specimen failing to meet the requirements. Should the retest fail, the fabricator shall take suitable remedial action to insure that the procedure is correct prior to the preparation of an additional set of test plates.

(f) The macro-etch specimen with the weld reinforcement in place shall be etched with a reagent which will clearly define the weld grain structure. After the specimen is etched it shall be given a protective coating to prevent oxidation.

(g) Results of the physical tests, the etch specimen and a sketch showing joint preparation, together with the information required in paragraph (b) of this section, shall be forwarded to the Commandant for consideration prior to the fabricator using the process in production welding.

(h) The fabricator shall prepare a specification covering the procedure qualification as used in preparing the test plate and shall furnish a copy to the marine inspector. The procedure used in qualifying shall be employed in fabrication except that speed of welding, amperage and voltage may vary to suit different material thicknesses. If the joint design, filler metal or type of inert gas is changed or alloy steel is to be fabricated and carbon steel used in the preparation of the test plate, a new procedure qualification shall be conducted.

(i) The fabricator shall weld a test plate of the actual thickness to be used in production to demonstrate to an inspector that he is using the proper welding procedure to obtain complete penetration.




1. Assembly shall be brazed in horizontal, vertical, or flat position as applicable, heating shall be done from one side only.
2. Assembly shall be tested as indicated in figure 56.1-10 (j10).

FIGURE 56.01-10 (j9)—Qualification test No. 7.

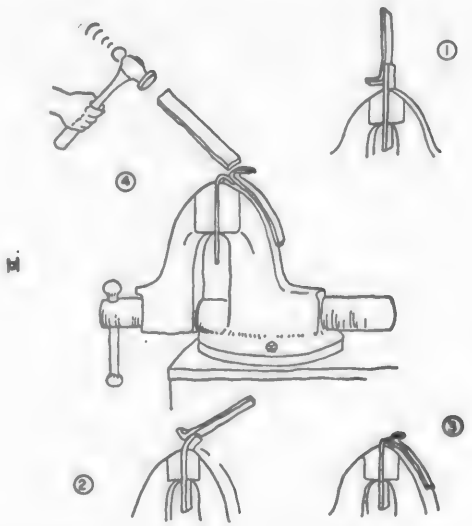



FIGURE 56.01-10 (j10)—Peel test for qualification test No. 7.

TABLE 56.01-15(c)—REQUIRED TESTS FOR PLATE GROOVE WELDS

| Test plate or pipe thickness T | Maximum production plate thickness | Number and type of tests required | | | | |
|---|---|---|---|---|---|---|
| | | Reduced section tensile | Root bend | Face bend | Side bend | Macro etch |
| 1/16 inch to and including 3/4 inch. | 2T | 2 | 2 | 2 | ------- | 1 |
| Over 3/4 inch | 2T for multiple pass welding | 2 | ------- | ------- | 4 | 1 |
| | 2T but not over 2 inches for welding one pass from each side. | 2 | ------- | ------- | 4 | 1 |
| | T for welding from one side only against a copper or melt backup. | 2 | ------- | ------- | 4 | 1 |

**§ 56.01-20 Arc welding electrodes.**

(a) Acceptable brand names of arc welding electrodes, as published in the Equipment Lists, CG-190, shall be used in the welded fabrication of machinery appurtenances and pressure-containing parts as given in § 56.01-1.

(b) Type E6012, E6013, E6014, E6024, E7014, or E7024 electrodes shall not be used in the fabrication of any item listed in paragraph (a) of this section.

**§ 56.01-25 Classes of arc-welded pressure vessels.**

For the purpose of the uniform application of the regulations in this subchapter, arc-welded pressure vessels shall be divided into three classes as given in Table 56.01-25.

TABLE 56.01-25—PRESSURE VESSEL CLASSIFICATION

| Class of pressure vessel | Service | Limitations: Pressure, p. s. i. | Limitations: Temperature, ° F. | Maximum metal thickness, in inches |
|---|---|---|---|---|
| I | Power boilers: All pressure parts | Over 30 | All | None |
| | Unfired pressure vessels containing: | | | |
| | (a) Vapors or gases | Over 600 | Over 700 | None |
| | (b) Liquids | Over [1] 600 | Over 400 | None |
| | (c) Dangerous substances | [2] | [2] | |
| II | Unfired pressure vessels containing: | | | |
| | (a) Vapors or gases | 31 to 600, inclusive | 276 to 700, inclusive | [3] 1 1/16 |
| | (b) Liquids | 201 to [1] 600, inclusive | 251 to 400, inclusive | [3] 1 1/2 |
| | (c) Dangerous substances | [2] | [2] | |
| III | Heating boilers: | | | |
| | (a) Steam | 30 and under | 275 and under | |
| | (b) Hot water | 30 and under | 250 and under | |
| | Unfired pressure vessels containing: | | | |
| | (a) Vapors or gases [4] | 30 and under | 275 and under [5] | [3] 5/8 |
| | (b) Liquids [4] | 200 and under | 250 and under [5] | [3] 5/8 |

[1] This pressure limitation does not apply to vessels containing liquids under hydrostatic pressure at atmospheric temperatures.
[2] Stored or stowed dangerous substances may be carried in either Class I or Class II pressure vessels within the pressure and temperature limits prescribed in Subchapter N (Dangerous Cargoes) of this chapter.
[3] The limit of plate thickness does not apply to heads formed from a single plate.
[4] Class III pressure vessels shall not be used for the storage or stowage of lethal gases or liquids or such dangerous substances which are regulated by the requirements of Subchapter N (Dangerous Cargoes) of this chapter.
[5] Class III pressure vessels shall not be used for the storage or stowage of gases or liquids at temperatures exceeding their boiling point at atmospheric pressure.

### § 56.01–30 Welded joint efficiencies.

(a) The maximum joint efficiencies to be used in the design of pressure vessels or parts of pressure vessels fabricated by arc or gas welding shall be as given in Table 56.01–30 (a). The joint efficiencies shall depend on the type of joint welded and on whether or not the pressure vessel is stress-relieved or radiographed.

(b) (1) A maximum joint efficiency of 1.00 may be used for Class I unfired pressure vessels provided the weld reinforcements are removed so that the full longitudinal and circumferential welds on both sides of the joints are substantially flush with the surface of the plates, except that for unfired pressure vessels having thicknesses not more than ½ inch and operating at ambient temperature the weld reinforcement shall meet the requirements of § 56.05–5(c) (3). The joint efficiency of 1.00 shall be limited to double welded butt joints, or to joints made equivalent to double welded butt joints by other means which will obtain the same quality of deposit weld metal on the inside and outside of the weld surfaces to agree with the requirements of § 56.05–5(c). Single welded butt joints using metal backing strips which remain in place are excluded.

(2) A maximum joint efficiency of 0.95 may be used for Class I pressure vessels provided the weld reinforcement is removed so that the longitudinal weld(s) on both sides of the joint is substantially flush with the surface of the plates, and on all intersecting butt-welded circumferential joints the reinforcement is similarly removed five times the plate thickness (or 6 inches whichever is less) on each side adjacent to any longitudinal joint.

### § 56.01–40 Material.

(a) Ferrous and nonferrous material for use in fabrication of shells and heads of welded pressure vessels shall comply with the grades of material specified in Part 51 of this subchapter as suitable for arc or gas welding.

(b) Wrought, cast, or forged materials shall be of good weldable quality having a carbon content not exceeding 0.35 percent and other chemical elements affecting weldability shall not exceed a percentage which may cause fabrication difficulty.

TABLE 56.01-30(a)—MAXIMUM ALLOWABLE EFFICIENCIES FOR WELDED JOINTS [1]

| Type of joint | Limitations | Basic joint efficiency (percent) [2] | Radiographed | Thermally stress-relieved | Maximum joint efficiency (percent) |
|---|---|---|---|---|---|
| Double-welded butt joint. | Unfired pressure vessels | 90 | R | R | [3] 100 |
| | Class I welded pressure vessel | | R | R | [3] 95 |
| | | | R | R | 90 |
| Single-welded butt joint with backing strip. [4] | Longitudinal joint maximum thickness 1¼ inches. No thickness limitation on circumferential joints. If welds not radiographed and stress-relieved this type joint limited to Class II and III welded pressure vessel. | 80 | R | NR | 85 |
| | | | NR | R | 85 |
| | | | NR | NR | 80 |
| Single-welded butt joint without backing strip. [4] | Circumferential joints only. Maximum thickness ⅝ inch. Limited to Class II and III welded pressure vessel. | 70 | NR | R | 75 |
| | | | NR | NR | 70 |
| Doubled-welded full-fillet lap joints. | Longitudinal joints maximum thickness ⅝ inch. Circumferential joints maximum thickness ⅝ inch. Limited to Class III welded pressure vessel. | 65 | NR | R | 70 |
| | | | NR | NR | [5] |

R—Indicates "Required."
NR—Indicates "Not Required."

[1] See § 56.01–25 for classes of welded pressure vessels and Subpart 56.10 for unfired brazed pressure vessel requirements.
[2] Spot examination required by § 56.05–6 unless specifically exempted.
[3] Weld reinforcement required to be removed (see § 56.01–30 (b)).
[4] Where not possible to employ doubled-welded butt joint the above type may be considered equivalent to a double-welded joint if the requirements of § 56.01–55 are met.
[5] In welding single-welded butt joints, complete penetration at the root is required, which must be demonstrated by the qualification of the procedure to be used. If complete penetration cannot otherwise be secured, the procedure shall include a backing ring or equivalent.

### § 56.01–45 Calculations.

(a) The minimum thickness and maximum allowable pressure for shells of welded pressure vessels shall be determined by § 52.05–10 of this subchapter.

(b) The minimum thickness and maximum allowable pressure for heads of welded pressure vessels shall be determined by §§ 52.20–10 and 52.22–10 of this subchapter.

(c) The minimum thickness and maximum allowable pressure for welded piping shall be determined by § 55.07–5 of this subchapter.

### § 56.01–50 Detail requirements.

(a) The surfaces of parts to be welded shall be cleaned of scale, rust, and grease at least ½ inch from the welding edge. Grease or oil may be removed by a nonhazardous solvent. A wire brush may be used to remove light corrosion or mill scale. Heavy mill scale, slag, etc., shall be removed by chisel, air hammer, or other suitable tool to secure clean metal. (Discoloration resulting from flame cutting is not considered detrimental oxidation.) When it is necessary to deposit metal over a previously welded surface any scale or slag existing thereon shall be removed by a suitable means to prevent the inclusion of heterogeneous matter in the weld metal.

(b) The members to be joined shall be accurately cut to size and form. In all cases the forming shall be done by pressure and not by blows, including the edges of the plates forming longitudinal joints of cylindrical shells.

(c) Precaution shall be taken in the preparation of joints in which fillet welds are used in order to secure fusion of the weld metal at root of the fillet. Care shall also be exercised in depositing the weld metal so as to secure satisfactory penetration.

(d) If the thickness of the flange of a head to be attached to a cylindrical shell by a butt joint exceeds the shell thickness by more than 25 percent (maximum ¼ inch), the flange thickness shall be reduced at the abutting edges as shown in figure 56.01–50 (d).

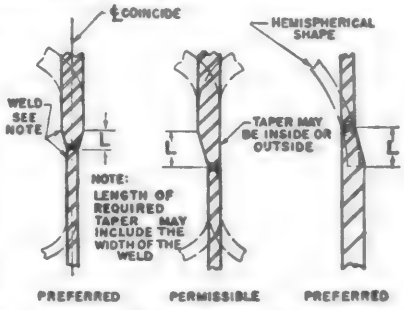

℄ COINCIDE
HEMISPHERICAL SHAPE
WELD SEE NOTE
TAPER MAY BE INSIDE OR OUTSIDE
NOTE:
LENGTH OF REQUIRED TAPER MAY INCLUDE THE WIDTH OF THE WELD
PREFERRED
PERMISSIBLE
PREFERRED
L SHALL NOT BE LESS THAN FOUR TIMES THE OFFSET BETWEEN THE ABUTTING PLATES

FIGURE 56.01–50 (d)—Types of joints for material of unequal thicknesses.

(e) The edges of the plates at the joints shall not have an offset from each other at any point in excess of one-quarter of the plate thickness at the joint, with a maximum permissible offset of ⅛ inch

for longitudinal joints and ¼ inch for circumferential joints.

(f) Where plates of unequal thicknesses are abutted, the edge of the thicker plate shall be reduced so that it is approximately the same thickness of the thinner plate. The middle lines of plate thicknesses for longitudinal shell joints shall be within the limits as given in paragraph (e) of this section.

(g) Except where specifically permitted in other sections, the design of welded pressure vessels shall be such that if the welded joint is subjected to a bending stress, the design shall be analysed so that the maximum stress will be within allowable limits. Complete penetration of the weld metal through the members joined shall be secured plus the addition of fillet welds where necessary to reduce stress concentration. Corner joints with members attached only by fillet welds where a concentrated bending stress will occur at the root of the weld are not permitted unless the members forming the corner are adequately supported independently of such welds.

(h) Bars, jacks, clamps, or other appropriate tools may be used to hold the edges to be welded in line. The edges of butt joints shall be held so that they will not overlap during welding. Where fillet welds are used, the lapped plates shall fit closely and be held together during welding.

(i) The joint preparation of the material to be welded shall be such as to permit good fusion and complete penetration where butt welds are employed.

(j) Double-welded butt joints shall have the reverse sides chipped, ground, or melted out, so as to secure a clean surface of the originally deposited weld metal, prior to depositing the first bead of welding on the reverse side. Chipping, grinding, or melting out shall be done in a manner that will insure proper fusion of the weld metal. The foregoing requirements do not apply to processes of welding whereby proper fusion and penetration are obtained and heterogeneous matter is eliminated from the root of the weld.

(k) If the welding is stopped for any reason, extra care shall be taken in restarting to secure complete penetration at the root of the weld and thorough fusion between the weld metal and the plates, and to the weld metal previously deposited.

(l) If single-welded butt joints are used, care shall be taken in aligning and separating the edges to be joined so that complete penetration and fusion at the root of the weld will be assured.

**§ 56.01–55 Joints.**

(a) (1) Longitudinal joints of Class I and Class II pressure vessels shall be of the double-welded butt type and a reinforcement of at least 1/16 inch shall be provided on each face of the weld, except for plates of ¼ inch or less in thickness the reinforcement need not exceed 25 percent of the plate thickness. The reinforcement on either or both faces of the weld may be removed, but if not removed shall be free of grooves, valleys, or other change in contour along the edge or upon the surface of the weld if the inspector deems such to be objectionable.

(2) When a single-welded butt joint is made the equivalent of a double welded joint by using a backing bar or its equivalent and depositing the filler metal from only one side to secure complete penetration, the requirements for reinforcement applies only to the face of the weld. The backing bar may be left in place or it may be removed. The root gap of 3/16 inch minimum shall be provided.

(3) Where the reverse side of a welded joint is not accessible, a single-welded butt joint employing an inert gas and/or consumable insert ring for the first pass back-up may be considered the equivalent to a double-welded butt joint, provided the welding procedure qualification tests are conducted in conformance with the requirements of § 56.01–15.

(b) The longitudinal joints of Class III welded pressure vessels shall be as given in § 56.01–30. The weld reinforcement shall be as required in paragraph (a) of this section. Fillet welds of lap type joints shall have a throat dimension of not less than 5/8$T$, where $T$ is the thickness of the shell plate. The surface of the overlap shall be not less than 4$T$.

(c) Circumferential joints for Class I pressure vessels shall be of the double-welded butt type. Circumferential joints for Class II pressure vessels shall be of the double-welded butt type except for thicknesses of ⅝ inch or less, in which case they may be of the single-welded butt type. Circumferential joints on Class III pressure vessels may be of the butt or lap type. The details of all joints shall conform to the requirements for longitudinal joints, as given in paragraph (a) of this section.

(d) Dished heads concave to the pressure when used on Class III pressure vessels shall be inserted with a driving fit and fillet welded inside and outside, except that for vessels 20 inches in diameter or less the heads may be welded on the outside only. The welds shall be located on the flange of the head at a distance not less than twice the thickness of the head from the point of tangency of the knuckle and in no case less than ½ inch. Dished heads concave to the pressure shall have a length of flange not less than one inch for shells not over 24 inches in diameter. For shells over 24 inches in diameter, this length shall not be less than 1½ inches.

(e) Dished heads convex to the pressure shall have a flange not less than 1½ inches long except where the flange thickness is ⅜ inch or under, in which case the flange need not be more than four times the thickness of the head. When heads are inserted into the shell, same shall be with a driving fit and welded as shown in Figure 56.01–55(e).

(f) Heads concave to the pressure and plates having circumferential joints to be attached by butt welds shall be aligned so that the deviations are not more than permitted by the limitations given in § 56.01–50, but if greater, correction shall be made by reforming the shell or head, whichever is out of true, until the errors are within the limits specified. The edges of head and circumferential joints shall be separated by a suitable root gap to insure complete penetration of the weld metal.

(g) Intermediate heads of the type shown in Figure 56.01–55(e) may be used for all classes of pressure vessels provided the outside diameter of the head skirt is a close fit inside the overlapping ends of the shell courses. The butt weld and fillet weld shall be designed to take shear at 1½ times the maximum pressure on either side of the head, but in no case less than 50 p.s.i.

(h) Flat heads may be attached to pressure vessels in accordance with the requirements of § 52.22–10 of this subchapter.

(i) The welder's symbol shall be stamped on each pressure vessel adjacent to the weld and at intervals not to exceed three feet along the welds made manually or by machine. In lieu thereof, a permanent record may be kept by the manufacturer furnishing the name of the welder employed in making each joint. This record shall be made available to the inspector upon request.

**§ 56.01–57 Unreinforced holes in welded joints.**

(a) Unreinforced holes may be machine-cut through welded seams which have been stress-relieved and radiographed. The joint efficiency as well as the ligament efficiency shall be con-

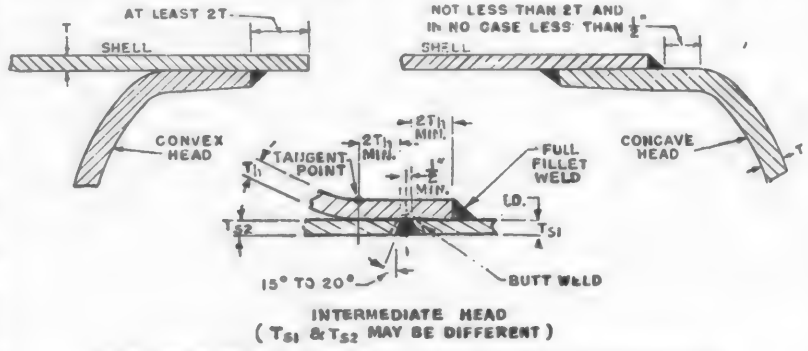



FIGURE 56.01–55(e)—Details of circumferential joints of dished heads.

sidered in calculating the required thickness.

(b) Tubes may be rolled and expanded in such unreinforced holes, or such holes may be threaded: *Provided*, That in the portion of the welded joint in which the holes are cut the following additional requirements are fulfilled:

(1) The welds shall be examined by the paramagnetic powder method on both sides and found to be satisfactory.

(2) The weld shall contain no slag inclusion or defect longer than 0.15T (where T is the thickness of the weld), but in no case greater than ⅜ inch.

(c) If either or both paragraphs (b) (1) and (b) (2) of this section are not complied with, the unreinforced holes for threaded connections or for rolled or expanded tubes may not be placed closer than ¼ inch to the edge of the fused metal, and no deduction need be made in the maximum allowable pressure computed for the same tube layout without a circumferential weld.

**§ 56.01–65 Seal welding and tack welding.**

(a) Seal welding may be used for the purpose of securing tightness of connections where the structure is such that no strain is placed upon the weld. Seal welding consists of depositing not more than two beads of weld metal. The throat of the weld shall not exceed ¼ inch and the size of the electrode employed shall not exceed 5/16 inch diameter. Seal welds are not required to be stress-relieved.

(b) Intermittent welding may be used for attaching internal baffles, strainers, external lugs, securing lagging, etc., provided the welds are of at least two passes, do not have a throat exceeding ¼ inch, are not more than 3 inches in length and have a center to center distance of at least twice their length.

(c) Intermittent welding and seal welding shall be done by qualified welders using acceptable electrodes (see § 56.01–20). Intermittent or seal welding shall not be done when the temperature of the metal of a pressure vessel is below 50° F. unless the base metal is preheated and held at a temperature of at least 200° F.

**§ 56.01–70 Preheating and stress relieving.**

(a) All Class I welded pressure vessels unless specifically exempted in other sections of this subchapter, shall be stress-relieved to dissipate the major portion of the residual stresses.

(b) Stress relieving shall be done by heating the weldment slowly and uniformly to a temperature of from 1,100° F. to 1,200° F. for carbon-steel and held at that temperature for a period of time proportioned on the basis of at least one hour per inch of thickness and allowed to remain in the furnace until 500° F. is reached at which time the weldment may be withdrawn and allowed to cool in a still atmosphere. When a weldment of various thicknesses of material is stress-relieved, the thickest section of the parts welded shall govern the length of time required for soaking. Pressure vessels fabricated of carbon-steel exceeding ½-inch in thickness shall be preheated locally to 125° F., prior to welding, when the ambient temperature is below 50° F. Alloy materials usually require different stress-relieving temperatures due to different chemical properties of the material. The heat treatment covering preheating and stress relieving to be employed on the latter types of materials shall be in accordance with the recommendations of the manufacturer of the material and as specifically approved by the Commandant.

(c) When the vessel is required to be stress-relieved, all connections attached by arc or gas welding unless specifically exempted shall also be stress-relieved as required by this part.

(d) Local stress relieving of welds shall be performed by means of electrical inductance, electrical resistance, or other acceptable means whereby the temperature is accurately controlled. When a type of stress relief is used that produces direct radiation, the thermocouple shall be insulated so that the hot junction of the thermocouple will not be subject to the heat of radiation. Pyrometric equipment shall be provided to indicate the hottest and coolest points of the weldment. If the weldment is of appreciable size, the number of thermocouples provided shall be sufficient to insure complete coverage. The temperature of the weldment shall be considered as being the average of the observed temperature.

(e) The stress relieving operations shall be indicated by pyrometric equipment. When an autographic record of local stress-relieving operations is made, this record shall be maintained by the fabricator.

(f) The weldment shall be stress-relieved by one of the methods as follows:

(1) Heating the complete structure as a unit.

(2) Heating a section containing the part or parts to be stress-relieved. In employing this method of stress relief direct flame impingement shall be avoided.

(3) Circumferential joints may be stress-relieved by uniformly heating a circumferential band having a minimum width of six times the material thickness on each side of the welded joint in such a manner that the entire band is brought up to the required temperature and held for the period specified in paragraph (b) of this section.

(4) Pipe shall be stress-relieved by heating a circumferential band having a width of at least 3 times the width of the widest part of the welding groove but not less than 6 times the maximum wall thickness at the weld with the weld at the center of the band. Where pipe is welded to a valve the heated zone may be decreased on the valve side of the joint to a minimum of one times the width of the weld reinforcement measured from the edge of the reinforcement toward the valve.

(5) Nozzles or other welded attachments which are required to be stress-relieved may be locally stress-relieved by heating a circumferential band around the entire vessel with the connection at the middle of the band to the required temperature and length of time specified for stress relieving. The band width shall be a minimum of six times the shell thickness on each side of the attachment.

(g) Except where specifically allowed in other sections in this subchapter, all nozzle connections after being attached by welding on Class I welded pressure vessels shall be stress-relieved.

(h) (1) Class II welded pressure vessels shall be stress-relieved under the following conditions:

(i) If required by Figure 56.01–70(h).

(ii) If fabricated of steel plate exceeding 0.58 inch thickness conforming to specifications A202, A203, A204, A225, A299, A387 Grade A, and for any steel having a specified molybdenum content of 0.50 percent nominal (permissible range 0.40 to 0.65 percent) with a chromium content not greater than 0.70 percent.

(iii) If fabricated of steel conforming to specifications A302, A387 Grades B and C, D and E, and for a chrome-molybdenum steel having a chromium content greater than 0.70 percent.

(iv) If fabricated as a Class II pressure vessel for use as a cargo tank for the storage or transportation of liquefied compressed gases and if designed for pressures exceeding 100 pounds per square inch.

(2) When class II welded pressure vessels are required to be stress-relieved, all nozzles or other welded attachments when joined by arc- or gas-welding shall be stress-relieved. When class II welded pressure vessels are not required to be stress-relieved, unreinforced nozzle connections and other attachments when joined by arc- or gas-welding are not required to be stress-relieved.

(3) When nozzles are reinforced with pads having a thickness greater than that of the shell or head to which they are attached, the nozzles shall be stress-relieved.

(i) Arc- or gas-welded connections may be added to class I and class II welded pressure vessels after they have been stress-relieved, without requiring stress-relief, provided:

(1) The diameter of the attachment opening in the vessel walls does not exceed that allowed for an unreinforced opening or does not exceed 2 inches, whichever is smaller; and,

(2) The inside and outside attachment welds do not exceed ⅜ inch throat dimension.

(3) This paragraph does not apply to those connections so placed as to form ligaments in the shell, the efficiency of which will affect the shell thickness. Such added connections shall be stress-relieved.

(j) All connections attached by arc or gas welding to vessels fabricated by other means shall be stress-relieved in accordance with the requirements for connections on class II pressure vessels. If any such vessels are to be used for service equivalent to class I pressure vessels, arc- or gas-welded connections shall be stress-relieved.

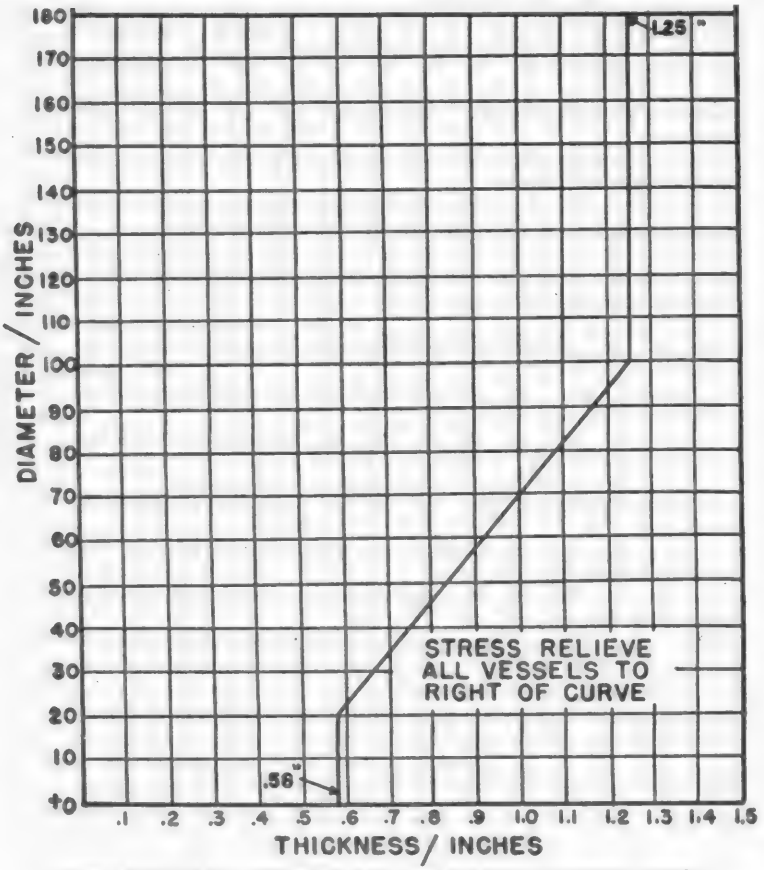



FIGURE 56.01-70 (h)—Stress relief diagram for class II pressure vessels.

(k) Arc- or gas-welded connections which require stress relieving and which are attached to vessels whose seams are of riveted construction shall be fabricated and stress-relieved prior to the making up or attachment of the courses by riveting. If they do not require stress relieving and are attached after riveting, the welds shall be located at a distance from the riveted seam at least equal to the diameter of the opening plus four times the plate thickness of the shell.

(l) All vessels containing lethal liquids or gases shall be stress-relieved. Any vessels containing liquids, gases or other substances which Part 38 of Subchapter D (Tank Vessels) or Part 146 or 147 of Subchapter N (Dangerous Cargoes) of this subchapter require to be fabricated in accordance with a class of pressure vessel requiring stress relief shall be stress-relieved.

(m) Cold weldments shall not be placed in the furnace when the temperature therein exceeds 500° F. Upon cooling, the weldment may be removed from the furnace when the temperature of same has reached 500° F. and allowed to cool in still air to assure a gradual decrease in temperature.

**§ 56.01-75 Distortion.**

Drums of welded or brazed pressure vessels shall be circular at any section within a limit of one percent of the mean diameter, based on the difference between the maximum and minimum mean diameter at any section If necessary to meet the foregoing requirement, the drum shall be reheated, rerolled, or reformed. To determine the difference in diameters, measurements may be made on the inside or the outside, and when the drum is fabricated of plates of unequal thickness, the measurements shall be corrected for plate thicknesses to determine the diameter at the middle line of the plate thickness.

**§ 56.01-80 Welded piping.**

(a) Piping materials complying with Part 51 of this subchapter may be joined by means of arc or gas welding provided the fabrication complies with the requirements of this section.

(b) The requirements of this section are applicable to class I piping (see Part 55 of this subchapter) and class II piping unless specifically exempted.

(c) Sections of pipe shall be welded insofar as possible in the fabricating shop. Prior to welding class I piping, the fabricator shall request an inspector to visit his plant to examine his fabricating equipment and to witness the qualification tests required by § 56.01-10. One test specimen shall be prepared for each process and welding position to be employed in the fabrication.

(d) (1) For Class I piping, double-welded butt joints or single-welded butt joints using a backing ring or its equivalent on the inside of the pipe, shall be employed for pipe diameters exceeding ¾ inches, except as permitted in this paragraph. Single-welded butt joints employing an inert gas and/or consumable insert ring for first pass back-up may be considered the equivalent to a double-welded butt joint, provided the welding procedure qualification tests are conducted in conformance with the requirements of § 56.01-15. Piping of diameters not exceeding 2 inches may be joined by sleeves fitted over the pipe ends, or by socket joints provided the size of each fillet weld is at least 1¼ times the tube or pipe wall thickness and the weld deposited with a minimum of two layers. Slip-on flanges complying with the 150-pound and 300-pound standards may be used in Class I piping for temperatures not exceeding that permitted in § 55.07-15(b) of this subchapter.

(2) Some acceptable types of weld pipe connections are shown in figure 56.01-80 (d).

(3) For carbon-steel material the backing ring for class I piping shall be of low-carbon steel and shall be of the plain type or a type with projections spaced intermittently around the outside of the periphery to establish a minimum root gap as shown in figure 56.01-80 (d), detail F. For alloy steel material the backing ring shall have heat resisting properties equivalent to that of the material being welded except carbon steel backing rings may be used when welding carbon-molybdenum material.

(e) For class II piping, the type of joints shall be similar to class I piping, with the following exceptions:

(1) Single-welded butt joints may be employed without the use of backing rings in all sizes provided that the weld is chipped or ground flush on the root side of the weld.

(2) For services such as vents, overflows, and gravity drains, the backing ring may be eliminated and the root of the weld need not be ground.

(3) Square-groove welds without edge preparation may be employed for butt joints in vents, overflows, and gravity drains where the pipe wall thickness does not exceed 3/16 inch.

(4) The crimped or forged backing ring with continuous projection around the outside of the ring is acceptable only for class II piping.

(f) All butt welds shall be reinforced at the center of the weld by not less than 10 percent of the wall thickness for pipe or tubes for thicknesses not exceeding ⅝ inch; pipes and tubes having a wall thickness exceeding ⅝ inch shall be reinforced by at least 1/16 inch. The reinforcement shall be free of grooves, valleys, or other changes in contour along the edge or upon the surface of the weld if the inspector deems such to be objectionable.

(g) Each butt-welded joint of class I piping shall be marked with the welder's identification symbol. Dies shall not be used to mark the pipe where the pressure exceeds 600 p. s. i. or the temperature exceeds 750 degrees F.

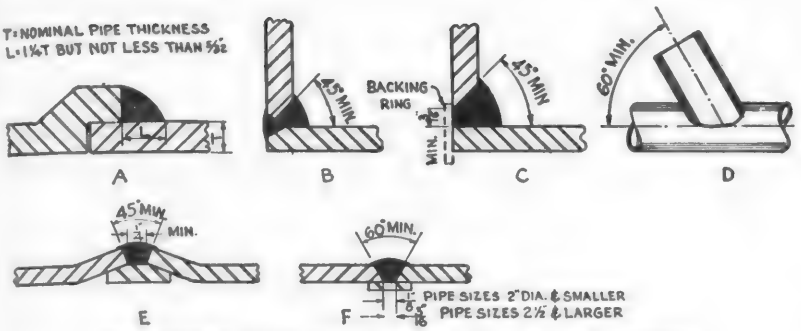



FIGURE 56.01–80 (d)—Acceptable types of welded pipe connections.

CONTRACTOR'S NAME _____

ADDRESS _____

PROCESS _____ DATE _____

MATERIAL (BASE METAL _____
(FILLER METAL _____

For Gas Welding
Type of Flame

_____

For Arc Welding
Type of Current

_____

If D. C., state polarity.

_____

IDENTIFICATION SYMBOLS OF THIS WELD

| | PASS NUMBER | HEAT | INPUT | DATA | DIAM. OF FILLER METAL | TEMP. DEG. F* | REMARKS |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| In above space indicate edge preparation and relative position of each pass as deposited. | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

*Give degree of preheat, if any. Indicate temperature of weld metal just prior to the deposition of each succeeding pass.

Cleaning of Passes _____

Treatment of Defects _____

Peening _____

Heat Treatment (Temp. _____ Name of welder _____
(Time _____ Name of Recorder _____
(Cooling _____

FIGURE 56.01–80 (m)—Manufacturer's record of welding process.

(h) All butt-welded joints in Class I piping exceeding 2½ inches in diameter, with the exception of high-pressure salt water piping systems used in tank cleaning operations and gas supply piping of carbon or carbon molybdenum steel used in gas turbines shall be stress-relieved as required by § 56.01–70.

(i) All complicated connections including manifolds, shall be stress-relieved in a furnace as a whole as required by § 56.01–70 before being taken aboard ship for installation.

(j) Class I carbon-steel and alloy-steel piping exceeding 2½ inches in diameter shall be preheated as required by § 56.01–70.

(k) (1) All butt-welded joints in Class I piping exceeding 2½ inches in diameter, with the exception of high-pressure salt water piping systems used in tank cleaning operations and gas supply piping of carbon or carbon molybdenum steel used in gas turbines shall be nondestructively tested as required by § 56.05–5.

(2) All welds shall be free of grooves and depressions. Surfaces of welded joints which are to be magnetic powder tested shall be made smooth of all surface irregularities so that the powder may properly indicate any fracture or defect.

(l) The base material and joint preparation for welding shall comply with the manufacturer's process record.

(m) A complete record of the manufacturer's process shall be maintained on the form shown by figure 56.01–80 (m) to establish definite limits of all essential variables involved. The manufacturer shall, after his welding process has been approved, conduct all welding in accordance with the requirements of his process record.

**§ 56.01–85 Welded pipe fittings.**

(a) Welded pipe fittings fabricated in conformance with the ASTM Standards shall be tested as required by the applicable specifications listed in Subpart 51.46 of this subchapter.

(b) Special fittings fabricated by welding which do not conform to ASTM Standards shall comply with the following requirements:

(1) *Sizes 2½ inches and below.* (i) The longitudinal joints of welded fittings may be fabricated by either gas or arc welding.

(ii) The first fitting of each size from the production line and at least one fitting from each lot of 100 or fraction thereof shall be flattened cold until the opposite walls meet without the weld(s) developing any cracks.

(iii) One fitting of each size from each lot of 100 or fraction thereof shall be subjected to a bursting pressure which shall be not less than that for a seamless drawn pipe of the same size and thickness produced from equivalent strength material, as determined by the Barlow formula. If this fitting fails to meet

the prescribed test, the entire lot of fittings shall be rejected.

(2) *Sizes above 2½ inches.* (i) The longitudinal joints of welded pipe fittings shall be fabricated by arc welding.

(ii) For pressures exceeding 150 p. s. i., each fitting shall be radiographically examined as specified in § 56.05–5.

(iii) For pressures not exceeding 150 p. s. i., the first fitting of each size from the production line and at least one fitting of each size in each lot of 20 or fraction thereof shall be examined by radiography to insure that the welds are of acceptable quality.

(iv) One fitting of each size in each lot of 100 or fraction thereof shall be subjected to a bursting pressure which shall be not less than that for a seamless drawn pipe of the same size and thickness produced from equivalent strength material as determined by the Barlow formula. If this fitting fails to meet the prescribed test, the entire lot of fittings shall be rejected.

(3) *Welded joint.* Single welded butt joints without the use of backing strip may be employed in the fabrication of welded pipe fittings provided the radiographs indicate that complete penetration is obtained.

## Subpart 56.05—Tests and Inspection

### § 56.05–1 Test plates.

(a) Test plates shall be provided for class I and class II pressure vessels as hereinafter specified in this section.

(b) Except as otherwise specified in this section, a test plate of the same grade and thickness as the shell plate being welded shall be attached to the shell plate on one end of the longitudinal joint of each drum as shown in Figure 56.05–1 (b), so that the edges of the test plate to be welded are a continuation of and duplication of the corresponding edges of the longitudinal joint. For attached test plates, the weld metal shall be deposited in the test plate welding groove continuously with the weld metal deposited in the groove of the longitudinal joint. The test plate material may be taken from any part of one or more plates of the same heat from which the plates were rolled that was used in the fabrication of the welded pressure vessel. As an alternate method, the inspector may permit the use of separate test plates, provided the same welding process, procedure, and technique employed in the fabrication of the longitudinal joint are used in welding the test plates.

(c) When a test plate is welded for the longitudinal joints, none is required for the circumferential joints or nozzles of the same drum, providing the welding process, procedure and technique are the same. When a drum has only circumferential joints, a separate test plate of the same material as that from which the shell was fabricated shall be welded as specified in paragraph (b) of this section.

(d) No test plates are required for nozzles when the drum has neither longitudinal nor circumferential welded joints.

(e) Drums fabricated of carbon-steel plate having circumferential joints but no longitudinal joints shall have at least one set of test plates welded separately for each drum or for each 50 feet of aggregate circumferential joints of drums of the same grade of material being welded in succession whose plate thicknesses fall within a range of ¼ inch, and whose diameters vary by not more than 6 inches.

(f) (1) When several class I pressure vessels fabricated of carbon-steel plate are being welded in succession or at any one time, the plate thicknesses of which fall within a range of ¼ inch, each 50 lineal feet of longitudinal and circumferential joints may be considered as the equivalent of one vessel for which test plates required by paragraph (a) or (b) of this section shall be furnished. Drums fabricated of carbon molybdenum grade E, F, or G marine boiler steel plate shall be welded separately and at least one set of test plates as required by paragraph (a) or (b) of this section shall be furnished for each drum.

(2) For class II pressure vessels no more than one set of test plates need be provided for each 300 lineal feet of either or both longitudinal and circumferential joints.

(g) Test plates shall be made by the same welder producing the longitudinal and circumferential joints. If more than one welder is employed in the welding of the pressure vessel(s), the test plates shall be made by the welder designated by the marine inspector. The test plates shall be of the same thickness as the material being welded and shall be of sufficient size to provide two specimens of each type required, except that in the case of pressure vessels having no longitudinal seams, the test plate need be only of sufficient length to provide one set of test specimens, and if a retest is necessary, an additional set of test plates may be welded separately.

(h) For test plates ¾ inch or less in thickness, one reduced-section tensile specimen and two free-bend specimens shall be tested. For plates exceeding ¾ inch in thickness, one reduced-section tensile specimen, one free-bend specimen and one guided side-bend specimen shall be tested.

(i) The test plates shall be so supported that the warping due to welding shall not throw the finished test plate out of line by an angle of over 5°.

(j) Where the welding has warped the test plates, the plates shall be straightened before being stress-relieved. The test plates shall be subjected to the same stress-relieving operation as required by § 56.01–70. At no time shall the test plates be heated to a temperature higher than that used for stress relieving the vessel.

(k) The bend specimens shall be taken from opposite sides of the reduced section tensile specimen in their respective test plates as shown in figures 56.05–1 (k1) and 56.05–1 (k2).

(l) In submitting the samples for test the manufacturer shall state the minimum and maximum tensile range of the base metal. If this information is not available, he shall submit a test coupon of the solid plate machined to form as shown in figure 51.04–10(a) of this subchapter.

(m) The external appearances of the welds and the amount of weld reinforcement shall conform to the requirements for fabrication, and the maximum reinforcement for the test plates shall not exceed the maximum permitted for construction.

(n) (1) The tension-test specimen of the joint shall be transverse to the welded joint and shall be of the full thickness of the plate after the weld reinforcement has been machined flush. The form and dimensions shall be as shown in figure 56.05–1 (n1). When the capacity of the available testing machine does not permit testing a specimen of the full thickness of the welded plate, the specimen may be cut with a thin saw into as many portions of the thickness as necessary, as shown in figure 56.05–1 (n2), each of which shall meet the requirements. The tensile strength of the joint specimen when it breaks in the weld shall not be less than the minimum of the specified tensile range of the plate used. If the specimen breaks in the plate at not less than 95 percent of the minimum specified tensile range of the plate and the weld shows no sign of weakness, the test is considered acceptable.

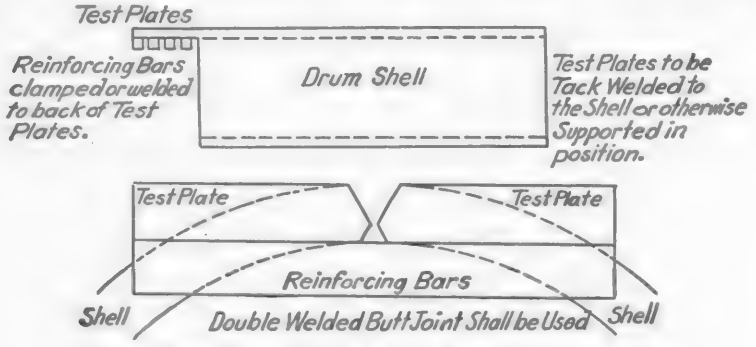

Test Plates
Reinforcing Bars clamped or welded to back of Test Plates.
Drum Shell
Test Plates to be Tack Welded to the Shell or otherwise Supported in position.
Test Plate
Test Plate
Reinforcing Bars
Shell
Double Welded Butt Joint Shall be Used
Shell

FIGURE 56.05–1 (b)—Method of forming longitudinal test plates.

(2) Boiler drums fabricated of plate of thicknesses of ⅝-inch or greater shall have a tension-test specimen of the weld metal machined to form as shown in figure 56.05–1 (n3) taken entirely from the deposited metal. The all-weld tension test specimen shall have a tensile strength of not less than the minimum of the range of the plate which is welded and shall have a minimum elongation in 2 inches of not less than 20 percent.

(o) The free bend specimens shall be of the form and dimensions shown in figure 56.05–1 (o). For plates of ¾ inch or less in thickness one of the specimens shall be bent with the face of the weld in tension. Each free bend specimen shall be bent cold under free-bending conditions until the elongation measured within or across approximately the entire weld on the outer surface of the bend is at least 30 percent. When the capacity of the available testing machine will not permit testing a full thickness specimen, the specimen may be cut with a thin saw into as many portions of the thickness as necessary, as shown in figure 56.05–1 (n2), provided each such piece retains the proportion of 1½ to 1, width to thickness, each of which shall meet the requirements. Cracks at the corners of the specimens or small defects in the convex surface, the greatest dimensions of which do not exceed ⅛ inch need not be considered as failures. For class II pressure vessels, the minimum elongation for the free bend specimen shall be 20 percent.

(p) The guided bend specimen shall be bent with the side of the weld in tension. Its width shall be equal to the full thickness of the plate and its thickness, after machining shall be 0.350 inch to 0.380 inch to permit bending in a jig having the contour of the standard jig as shown in figure 56.01–10(j6). The specimen shall withstand being bent cold to the full capacity of the jig without developing any crack exceeding ⅛ inch in any direction. Where the plate thickness exceeds 2 inches, the specimen shall be cut in two so that each portion does not exceed 2 inches in width. Each such portion shall be tested and shall meet the requirements.

(q) One retest shall be made for each of the original specimens which fails to meet the requirements. Should the retests fail to meet the requirements, the welds which they represent shall be chipped out, rewelded and new test plates provided. This shall apply to each shell in cases where a number of shells of the same design and grade of material are placed end to end and the longitudinal seams are welded continuously.

**§ 56.05–3 Qualification of radiographic test procedure.**

(a) Prior to the use of radiography by fabricators or commercial radiographic laboratories, the radiographic procedure proposed for use in nondestructive tests shall be qualified to demonstrate that the procedure will produce radiographs of acceptable standards.

(b) Radiographic test procedures qualified by the Bureau of Ships of the

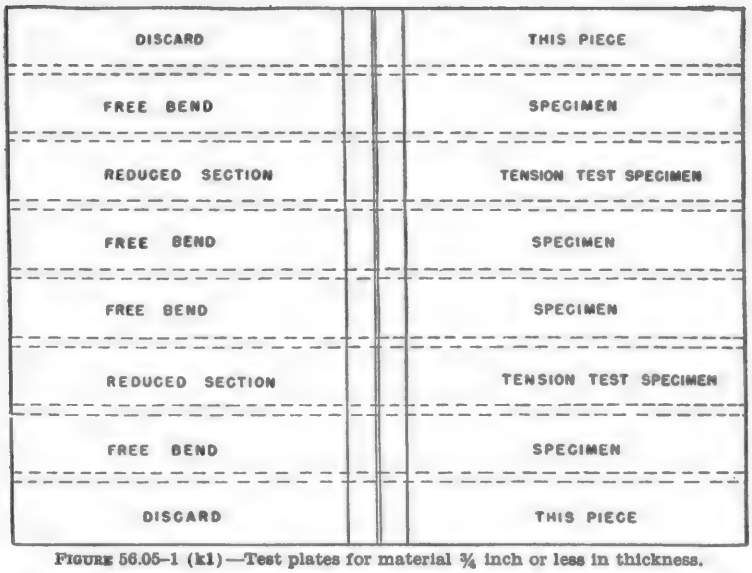



FIGURE 56.05–1 (k1)—Test plates for material ¾ inch or less in thickness.

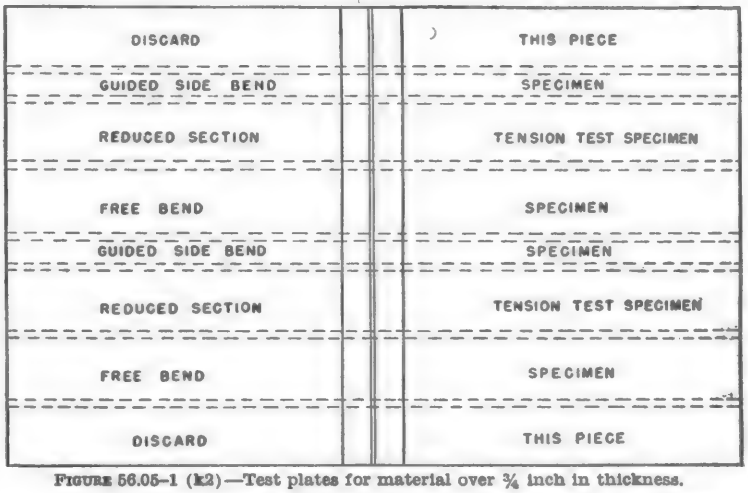



FIGURE 56.05–1 (k2)—Test plates for material over ¾ inch in thickness.

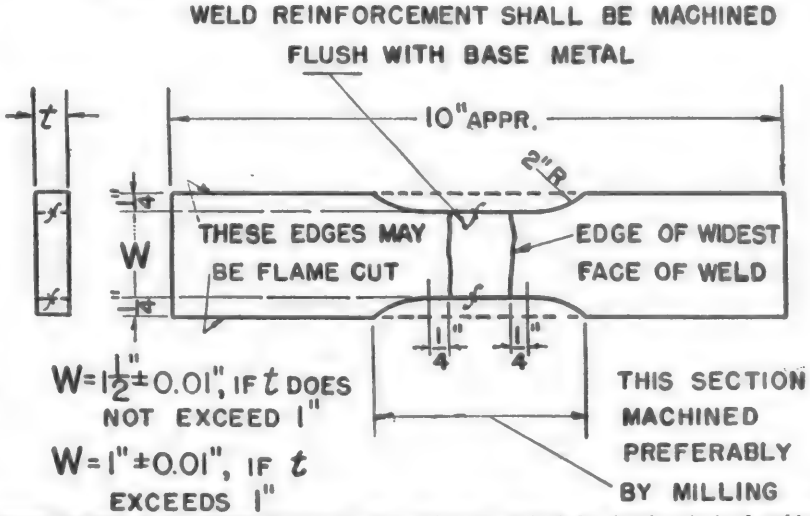

WELD REINFORCEMENT SHALL BE MACHINED FLUSH WITH BASE METAL
t
10" APPR.
2" R
W
THESE EDGES MAY BE FLAME CUT
EDGE OF WIDEST FACE OF WELD
1/4"
1/4"
W = 1 1/2" ± 0.01", IF t DOES NOT EXCEED 1"
W = 1" ± 0.01", IF t EXCEEDS 1"
THIS SECTION MACHINED PREFERABLY BY MILLING

FIGURE 56.05–1 (n1)—Reduced-section test specimen required for tension test of welded joint.

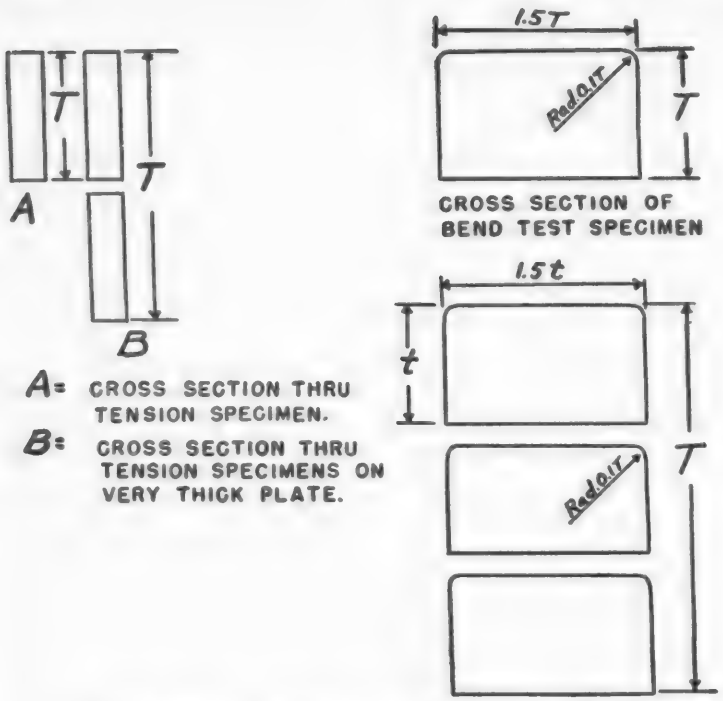



FIGURE 56.05–1 (n2)—Cross section of bend-test specimens from very thick plate.

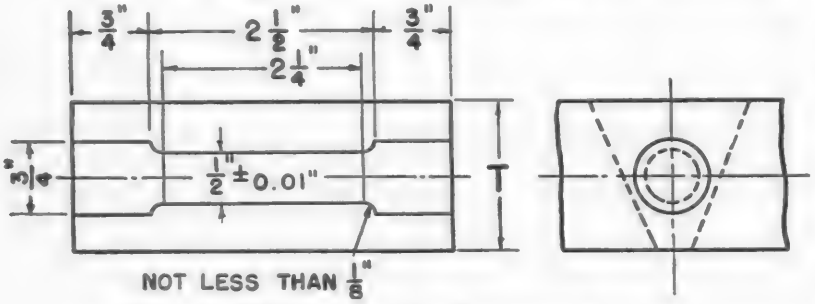



FIGURE 56.05–1 (n3)—All weld metal tension-test specimen.

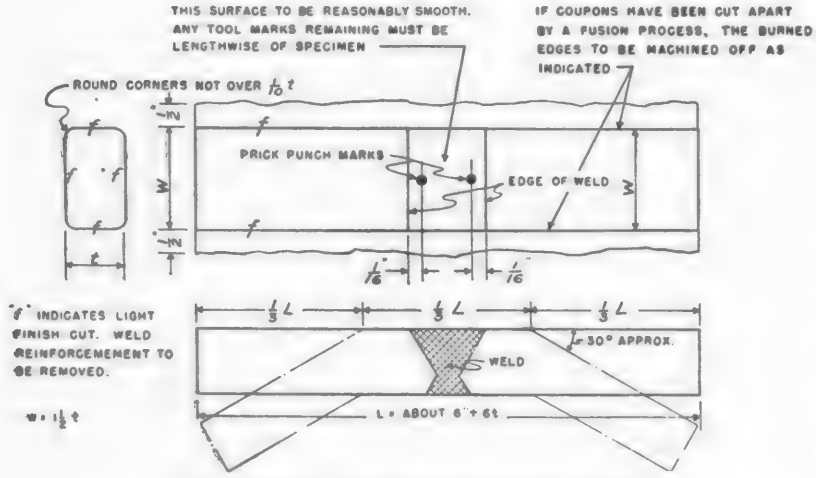

THIS SURFACE TO BE REASONABLY SMOOTH. ANY TOOL MARKS REMAINING MUST BE LENGTHWISE OF SPECIMEN
IF COUPONS HAVE BEEN CUT APART BY A FUSION PROCESS, THE BURNED EDGES TO BE MACHINED OFF AS INDICATED
ROUND CORNERS NOT OVER 1/10 t
PRICK PUNCH MARKS
EDGE OF WELD
1/16"
1/16"
"f" INDICATES LIGHT FINISH CUT. WELD REINFORCEMENT TO BE REMOVED.
w = 1 1/2 t
1/3 L
1/3 L
1/3 L
30° APPROX.
WELD
L = ABOUT 6" + 6t

FIGURE 56.05–1 (o)—Specimen for free-bend test.

Department of the Navy need not be requalified.

(c) Radiographic test procedures shall be qualified in the following manner:

(1) Radiographs shall be taken of test plates in accordance with § 56.05–5. Two radiographs shall be taken for each test plate. The thickness range being qualified shall be in accordance with Table 56.05–3(c). Test plates shall contain defects of known size in addition to the required penetrameters. Test plates shall be furnished by the fabricator or laboratory seeking qualification.

TABLE 56.05–3(c)

| Test plate thickness (Inches) | Thickness range qualified (Inches) |
|---|---|
| 3/4 | Up to 1 1/2. |
| 1 | 3/4 to 2. |
| 2 | 1 1/2 to 2 1/2. |
| 3 | 2 1/2 to 4. |
| 5 | 4 to 6. |
| 8 | 6 to 10. |
| 12 | 10 and over. |

(2) The completed radiographs, together with the following information shall be forwarded, via the Officer in Charge, Marine Inspection, to the Commandant, for evaluation:

(i) Radiation source and capacity.

(ii) Film brand.

(iii) Type and thickness of screens.

(iv) $d_e/t$ ratio, where $d_e$ and $t$ are defined in § 56.05–5(m).

(v) Description of test plates.

(vi) Processing technique.

(d) Test plates of various thicknesses may be made up by placing several rolled mild steel plates together, with the plate containing the defects on the radiation source side.

(e) Separate qualification tests are required for each type of radiation source to be used, and for plate and pipe radiography.

**§ 56.05–5 Nondestructive tests.**

(a)(1) All longitudinal and circumferential welded butt-joints of Class I welded pressure vessels shall be examined throughout their entire length, except as specifically exempted in other sections of this subchapter, by means of radiography, preferably by X-ray.

(2) Each welded butt-joint of Class II welded pressure vessels shall be examined throughout its entire length by means of radiography, preferably by X-ray, when the plate thickness at the welded joint exceeds 1½ inches, or when required by § 54.03–1 of this subchapter and Table 56.01–30(a).

(b)(1) All butt-welded joints of Class I piping, unless exempted by § 56.01–80, shall be nondestructively tested. Radiography shall be used for diameters or thicknesses as follows:

(i) Carbon steel when the pipe wall thickness exceeds ⅜ inch.

(ii) Alloy steel when the diameter is 4 inches or larger.

(2) Butt-welded joints of Class I piping of thicknesses and sizes not exceeding that specified in subparagraph (1) of this paragraph may be examined by means of magnetic particle testing. The surfaces to be inspected shall be clean,

dry, and free from oil, excessive rust, slag, and scale accumulation. All surface irregularities such as undercuts, overlaps, ripples, rough welds, etc., which may make interpretation of the magnetic indications difficult, shall be made smooth by grinding, chipping, or sandblasting.

(c) Welded joints to be radiographed shall be prepared as follows:

(1) The welded joints shall be representative of the completed weld to be placed in service.

(2) The weld ripples or weld surface irregularities, on both inside and outside, shall be removed by any suitable mechanical process to a degree such that the resulting radiographic contrast due to any remaining irregularities cannot mask or be confused with that of any objectionable defect.

(3) The finished surface of the reinforcement may have a crown of smooth contour not exceeding the following:

| Material thickness, inches: | *Maximum thickness of reinforcement, inches* |
|---|---|
| ½ and below | 1/16 |
| Over ½ to 1, inclusive | 3/32 |
| Over 1 to 2, inclusive | 1/8 |
| Over 2 | 5/32 |

(4) Single-welded butt-joints made the equivalent of double-welded butt-joints in accordance with § 56.01–55 may be radiographed without removal of the backing strip provided the backing strip image will not interfere with the interpretation of resultant radiographs.

(d) Radiographic examination shall be performed with a technique that will indicate the presence of defects having depths of 2 percent of the thickness of the material, or widths of 4 percent of the thickness of the material being examined. Penetrameters made of material having radiographic density approximately the same as that of the material being radiographed shall be used to determine the sensitivity of the radiographic technique being employed.

(e) Penetrameters of the type as shown in Figure 56.05–5(e) shall be used, and shall be placed on the radiation source side of the object being radiographed. All radiographs shall show the image of the penetrameter.

(f) Each penetrameter shall have three holes of diameters equal respectively to one, two, and four times the penetrameter thickness, but in no case less than .010 inch for the 1T hole, .020 inch for the 2T hole, and .040 inch for the 4T hole. The 2T hole shall be distinguishable on the radiograph.

(g) Each penetrameter shall carry an identifying number representing, to two significant figures, the minimum thickness of plate for which it may be used. The images of the identifying numbers shall appear clearly on the radiographs.

(h) The thickness of the penetrameter shall be not more than 2 percent of the thickness of the material being examined. When the weld reinforcement and/or backing strip is not removed, a shim shall be placed under the penetrameter, such that the total thickness being radiographed under the penetrameter is the same as the total thickness through the weld, including backing strip when not removed.

(i) For metals of uniform thickness, each radiograph taken of welds shall have visible penetrameters and identification markers as follows:

(1) When the dimension of the film in the direction of the weld is 6 inches or less, one penetrameter is required.

(2) When the dimension of the film in the direction of the weld is over 6 inches, 2 penetrameters are required.

(3) The penetrameter(s) shall be placed at the end(s) of the exposed length, parallel and adjacent to the weld seam with the smallest hole at the outer end. When a single penetrameter is used, it shall be placed at the end of maximum angularity when there is a difference of angularity of radiation at the ends.

(4) For assembly welds, at least 2 identification markers are required. The distance between any two adjacent identification markers shall be not more than 6 inches.

(j) For metals of non-uniform thickness, such as castings, each radiograph taken shall have visible penetrameters as follows:

(1) Where the thickness of the metal does not vary over the area covered by a single radiograph by more than 50 percent of the maximum thickness or by more than ½ inch in thickness, whichever is the lesser, one penetrameter shall be used which shall be located at a point of mean thickness. In all cases where the longest dimension of a radiograph exceeds 6 inches, two penetrameters shall be used.

(2) If the thickness of metal covered by a single radiograph varies by more than 50 percent of the maximum thickness or by more than ½ inch, whichever is the lesser, suitable penetrameters shall be placed at the thinnest and thickest portion of the material being radiographed.

(3) Where the above requirements for placement on either the mean or maximum and minimum thickness permits, the penetrameter(s) shall be placed at the point(s) of maximum angularity of radiation.

(k) When an isotope capsule is placed at the center of a circumferential joint and the complete circumference radiographed with a single exposure, four penetrameters, uniformly spaced, shall be employed.

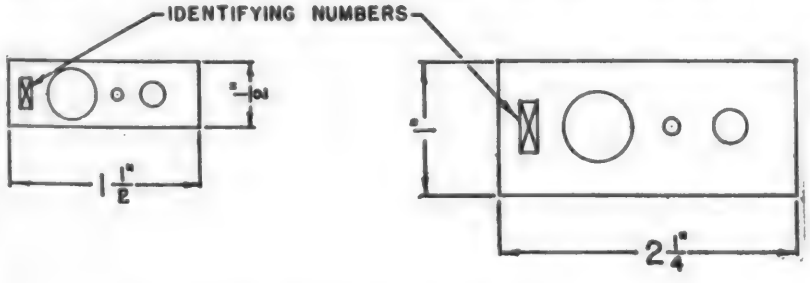
(l) Radiographic film for the inspection of welded joints or of weld repairs shall be high-contrast, slow speed, fine grain, or extra-fine grain, and used with lead screens. All radiographs shall be free from excessive mechanical processing defects which would interfere with the proper interpretation of the radiograph.

(m) The film during exposure shall be as close to the surface of the weld as practicable. Except where specifically provided for in the process qualification, the $d_o/t$ ratio shall be 7 or greater; where $d_o$ is the distance from the source of radiation to the surface of the test object toward the radiation source, and $t$ is the distance from the remotest part of the test object surface toward the radiation source to the film.

(n) Identification markers, the image of which is to appear on the film, shall be placed adjacent to the weld and their locations accurately and permanently marked near the weld on the outer surface of the plate or pipe, so that a defect appearing on the radiograph may be accurately located on the actual weld.

(o)(1) When radiographing a circumferential pipe joint or a casting by placing the radiation source inside the object, and where it is not feasible to place the penetrameters on the radiation side of the weld, the penetrameters may be placed on the film side if the requirements of subparagraph (2) of this paragraph are met.

(2) The radiographic technique shall be demonstrated with the applicable penetrameter placed on the source side and a continuous series of penetrameters placed on the film side of a like pipe section. The series of penetrameters shall range in thickness from 2 percent to 0.5 percent of the material thickness. If the penetrameter on the source side indicates the required sensitivity, the image of the smallest penetrameter hole visible on the film side shall be used to determine the penetrameter and pene-




DIAMETERS OF HOLES 1, 2, AND 4 TIMES THE THICKNESS OF PENETRAMETER.

FIGURE 56.05–5(e)—Details of penetrameters.

trameter hole which shall be used on inspection radiographs.

(p) For double wall radiographs in which only the portion of the weld next to the film is examined, and it is desired to place the penetrameter on the film side, the radiographic technique shall be demonstrated on a similar pipe section with the applicable penetrameter placed on the inside of the pipe along the root of the weld and a series of penetrameters, selected as in subparagraph (o)(2) of this section, placed on the film side. If the penetrameter on the source side of the portion of the weld indicates the required sensitivity, the image of the smallest penetrameter hole visible on the film side shall be used to determine the penetrameter and penetrameter holes which shall be used on inspection radiographs.

(q) The radiographs shall be submitted to the marine inspector with data as follows:

(1) The thickness of the metal being examined.

(2) The $d_o/t$ ratio.

(3) The X-ray voltage or isotope used.

(r) The acceptability of welds examined by radiography shall be judged by the following standards:

(1) Welds in which the radiographs show elongated slag inclusions or cavities are unacceptable if the length of any such imperfection is greater than $1/3T$ where $T$ is the thickness of the thinner plate welded. If several imperfections within the above limitations exist in line, the welds shall be judged acceptable if the sum of the longest dimensions of all such imperfections is not more than $T$ in a length of $12T$ and if the defects are separated by at least $6L$ of acceptable weld metal, where $L$ is the length of the longest imperfection. The maximum length of acceptable inclusion for any plate thickness shall be ¾ inch. Any slag inclusion shorter than ¼ inch shall be acceptable for any plate thickness.

(2) Welds in which the radiographs show any type of crack or zones of incomplete penetration shall be unacceptable. Incomplete penetration appears as elongated darkened lines of varying length and width in any part of the welding groove.

(3) Welds in which the radiographs show porosity shall be judged as acceptable or unacceptable by comparison with a standard set of radiographs, copies of which are on file at Coast Guard Headquarters, with the Coast Guard District Commanders, and with the Officers in Charge, Marine Inspection.

**§ 56.05–6 Spot examination of welded joints.**

(a) *Scope.* (1) All class II welded unfired pressure vessels which are not given a complete radiographic examination as specified by § 56.05–5 shall have portions of the finished welded joints examined by spot radiography, except vessels meeting the requirements of subparagraph (2) of this paragraph need not be so examined.

(2) Spot examination specified by subparagraph (1) of this paragraph is not required when an allowable stress of 80 percent of the values given in table 52.05–10(a) in Part 52 and table 54.03–10(c) in Part 54 of this subchapter is used in the design of the vessel.

(b) *Number required.* At least one spot shall be examined on each vessel welded having 50 feet or less of combined longitudinal and circumferential welds. For vessels having more than 50 feet of combined longitudinal and circumferential joints at least one spot shall be examined for each 50 feet or less of welded joints. If more than one welding procedure is employed or if more than one welder does the welding on a vessel, at least one spot shall be examined for each procedure and each welder. The spot(s) examined may be considered representative of the procedure, the welder and one interval of 50 feet of welded joint. The spot(s) to be examined shall be designated by an inspector.

(c) *Spot radiographing.* Each spot required by paragraph (b) shall be examined by radiography as prescribed in § 56.05–5. The spot radiographs shall meet the standards given in § 56.05–5(q). Retest radiographs permitted by paragraph (d) of this section shall comply with the standards given therein. Films of spot radiographs which have been examined by the inspector may be destroyed.

(d) *Retests*—(1) *Spot examination.* When a spot has been examined and the welding does not comply with the minimum quality requirements prescribed in paragraph (c) of this section, two additional spots shall be examined in the same joint at locations to be designated by the inspector, one on each side of and not far from the initial spot to determine the limits of defective welding, and if the welding at either of these spots fails to meet the minimum requirements of subparagraph (2) of this paragraph, additional nearby spots shall be examined until the limits of unacceptable welding are determined. In addition, the inspector shall require that an additional spot be examined at one location to be selected by him in each joint not previously examined on which the same welder has welded and if any additional spot fails to comply with the minimum quality requirements of paragraph (c) of this section, the limits of unacceptable welding shall be determined as described in this section. All rewelded areas shall be re-examined as required by the inspector and shall comply with the prescribed requirements in this section.

(2) *Radiographic standard for retest.* Welds in which the radiographs show any type of cracks or zones of incomplete penetration shall be unacceptable. Welds in which radiographs show elongated slag inclusions, cavities, or lack of fusion shall be unacceptable if the length of such imperfection is greater than 2/3T, where T is the thickness of the thinner plate. If several imperfections within the above limitations exist in line, the welds shall be judged acceptable if the sum of the longest dimension of all such imperfections is not more than T in length of 6T, and if the defects are separated by at least 6L of acceptable welding, when L is the length of the longest imperfection. The maximum permissible porosity shall not exceed that permitted by § 56.05–5, except that not more than twice as many cavities or slag inclusions, but of no greater size, shall be permitted within any single square inch of film area, or for the whole film area.

## Subpart 56.10—Brazing

**§ 56.10–1 Definition.**

Brazing is a group of metal-joining processes wherein the filler metal is a nonferrous metal or alloy whose melting point is higher than 800° F. but lower than that of the metals or alloys to be joined and is caused to flow, chiefly by capillarity, into the space between the two closely lapped or butted surfaces to be joined.

**§ 56.10–5 Detail requirements.**

(a) Unfired pressure vessels and pipe may be fabricated by brazing when the temperature to which such connections may be subjected does not exceed 425 degrees F.

(b) A manufacturer desiring to fabricate unfired pressure vessels shall conduct a process qualification test to demonstrate to an inspector that he has the proper equipment and his procedure is satisfactory for the production of acceptable work.

(c) The edges of the members to be joined shall be properly cleaned and made free from oxides, dirt, oil or grease prior to brazing. The edges of the plates may be punched and stitch riveted with centers not to exceed 3 inches or resistance welded with centers of spot welds not to exceed 1½ inches to hold the faying surfaces tightly together. The brazing shall be done by placing the flux and brazing material on one side of the joint and applying heat until the brazing material flows entirely through the lap and shows uniformly along the seam on the other side of the joint. Sufficient flux shall be used to cause the brazing to appear promptly after reaching the brazing temperature. The brazing material used shall have a shearing strength of at least 10,000 p. s. i.

(d) After the parts to be joined have been thoroughly cleaned the edges of same shall be given an even coating of flux prior to heating as a protection against oxidation.

(e) Heads shall be inserted into the shell with a tight drive or shrink fit and the protruding ends of the shell shall then be heated to a forging heat and crimped over the head.

**§ 56.10–10 Materials.**

Ferrous and nonferrous material for use in the fabrication of shells and heads of unfired pressure vessels shall comply with any of the grades of material specified in Part 51 of this subchapter. Steel pipe may be used for shells provided same is manufactured of seamless drawn or electric-resistance welded pipe.

**§ 56.10–15 Thickness and maximum allowable pressure.**

(a) The maximum allowable pressure for shells of brazed pressure vessels shall

be determined by § 52.05–10 of this subchapter.

(b) The maximum allowable pressure for heads of brazed pressure vessels shall be determined by §§ 52.20–10 and 52.22–10 of this subchapter.

(c) The maximum allowable pressure for brazed piping shall be determined by § 55.07–5 of this subchapter.

**§ 56.10–20 Types of joints.**

(a) The longitudinal joint may be of the lapped type where the material thickness does not exceed ⅜ inch. For thickness exceeding ⅜ inch, but not to exceed 1 inch, the longitudinal joint shall be of the double-butt strap type.

(b) Lap joints shall have the edge of the plate lapped a distance not less than eight times the plate thickness and for double-butt joints the lap of the inner and outer strap shall be not less than 16 times the thickness of the shell plating, one-half the lap to be on each side of the abutting plate edges. When the brazed joint does not extend the full length of the plate, the unbrazed edges may be arc- or gas-welded provided the length of the weld is not greater than four times the thickness of the shell plate from the edge of the flange of the head.

(c) Head and circumferential joints shall be brazed in approximately the same manner as the longitudinal joint. The end of the plate shall have an overlap of not less than four times the shell thickness. When a vessel is fabricated with more than one course in the shell, the circumferential joint may be of either the lap or butt type. If of the latter type, the courses shall be approximately a true circle and the circumference of the abutting courses shall not vary by more than 0.20 percent. The sleeve may be fitted to either the inside or the outside of the shell. The overlap in either case for each course shall be not less than four times the shell thickness.

**§ 56.10–25 Pipe joints.**

(a) Copper-alloy brazing may be employed to join pipe, valves, and fittings. Circumferential joints may be either of the butt or socket type. Where butt joints are employed, the included angle shall be not less than 90° where the wall thickness is 3/16 inch or greater. The annular clearance of socket joints shall be held to small clearances which experience indicates is satisfactory for the brazing alloy to be employed, method of heating, and material to be joined. The annular clearance shall be shown on drawings submitted for approval of socket joints.

(b) Copper pipe fabricated with longitudinal joints for pressures not exceeding that permitted by Part 55 of this subchapter, may have butt, lapped, or scarfed joints. If of the latter type, the kerf of the material shall be not less than 60°.

**§ 56.10–30 Silver brazing.**

(a) Circumferential pipe joints may be either of the socket or butt type. When butt joints are employed the edges to be joined shall be cut or machined square and the edges shall be held closely together to insure a satisfactory joint.

(b) The surfaces of the members to be joined shall be properly cleaned and given a coating of flux as required by § 56.10–5.

(c) Heat shall be applied evenly and uniformly to all parts of the joint in order to prevent local overheating.

(d) The members to be joined shall be held firmly in place until the silver brazing alloy has set so as to prevent any strain on the joint until the brazing alloy has thoroughly solidified.

(e) Clearances shall be between 0.002 inch minimum and 0.006 inch maximum.

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# PART 57—MAIN AND AUXILIARY MACHINERY

Subpart 57.01—General Requirements

Sec.

57.01–1 Scope.
57.01–5 Applicable standards.
57.01–10 Fuel for internal combustion engines on passenger vessels.
57.01–15 Fuel oil for boilers.

Subpart 57.05—Main Propulsion Machinery

57.05–1 Material, design and construction.
57.05–5 Astern power.

Subpart 57.10—Internal Combustion Engine Installations

57.10–1 Scope.
57.10–5 Gasoline engine installations.
57.10–10 Diesel engine installations.
57.10–15 Gas turbine installations.

Subpart 57.20—Refrigerating Machinery

57.20–1 Installation of refrigerating machinery.
57.20–5 Small portable, self-contained units.

Subpart 57.25—Steering Apparatus

57.25–1 Steering apparatus; existing installations.
57.25–5 Steering apparatus; new installations.
57.25–10 Rudder movement.
57.25–15 Plan approval.
57.25–20 Power-driven steering gear.
57.25–25 Auxiliary means of steering.
57.25–30 Steadying the rudder.
57.25–35 Rudder stops.
57.25–40 Buffers.
57.25–45 Pilothouse steering gear controls.
57.25–50 Alternative steering station steering gear controls.
57.25–55 Duplicate pilothouse steering gear controls systems.
57.25–60 Arrangement of steering wheels.
57.25–65 Special steering apparatus.
57.25–70 Steering gear piping.

Subpart 57.30—Nuclear Energy

57.30–1 Scope.
57.30–5 Definitions.
57.30–10 General safety requirements.
57.30–15 Special operating procedures.
57.30–20 Inspection, overhaul, and repairs.
57.30–25 Radiation protection.
57.30–30 Safety Assessment.
57.30–35 Operating Manual.

AUTHORITY: The provisions of this Part 57 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426–4431, as amended, 4433, as amended, 4434, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended. sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404–409, 411, 412, 435, 481, 489, 366, 395, 363, 367. 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857, unless otherwise noted.

## Subpart 57.01—General Requirements

**§ 57.01–1 Scope.**

(a) The regulations in this part contain requirements for the design and construction of main and auxiliary machinery installed on vessels subject to inspection by the Coast Guard, except as otherwise prescribed in this subchapter.

**§ 57.01–5 Applicable standards.**

In general the applicable standards established by the American Bureau of Shipping may be considered as standard for the design, construction, and testing of main and auxiliary machinery, except as modified in this subchapter.

**§ 57.01–10 Fuel for internal combustion engines on passenger vessels.**

(a) All internal combustion engines, whether used for main propulsion or auxiliaries, installed on passenger vessels exceeding 100 gross tons, or on all passenger vessels engaged in international voyages, shall be driven by fuel having a flashpoint exceeding 110 degrees F.

**§ 57.01–15 Fuel oil for boilers.**

Oil to be used as fuel to be burned under boilers on vessels subject to inspection by the Coast Guard shall have a flashpoint of not less than 150 degrees F. (Closed cup test.)

## Subpart 57.05—Main Propulsion Machinery

**§ 57.05–1 Material, design and construction.**

The material, design, construction and workmanship of main and auxiliary machinery shall be at least equivalent to the standards established by the American Bureau of Shipping or other recognized classification society.

**§ 57.05–5 Astern power.**

(a) All vessels shall have sufficient power for going astern to secure proper control of the ship in all normal circumstances.

## Subpart 57.10—Internal Combustion Engine Installations

**§ 57.10–1 Scope.**

The requirements in this subpart apply to all vessels subject to inspection. The requirements governing the installation of internal combustion engines on motorboats and motor vessels of more than 15 gross tons carrying passengers

for hire shall be effective on new vessels or vessels converted to passenger service for the first time, the construction of which is commenced on or after December 1, 1945, and to all existing vessels as far as it is practicable.

**§ 57.10–5 Gasoline engine installations.**

(a) *Engine design.* All installations shall be of marine type engines suitable for the intended service, designed and constructed in conformance with the requirements of this subchapter.

(b) *Carburetors.* (1) Drip collectors shall be fitted under all carburetors, except the down-draft type, to prevent fuel leakage from reaching the bilges and so arranged as to permit ready removal of such fuel leakage. Drip collectors shall be covered with flame screens.

(2) All gasoline engines shall be equipped with an approved means of backfire flame control. Installations of backfire flame arresters or engine air and fuel induction systems bearing basic Approval No. 162.015 may be continued in use as long as they are serviceable and in good condition. Backfire flame arresters or engine air and fuel induction systems installed or used on new installations or as replacements shall be of an approved type, design, construction, and tested in conformance with applicable requirements in Subpart 162.041 or 162.042 of Subchapter Q (Specifications) of this chapter. Air intakes shall be so directed that backfire cannot blow down into the bilge.

(c) *Exhaust manifold.* The exhaust manifold shall either be water-jacketed and cooled by discharge from a pump which operates whenever the engine is running, or woodwork within 9 inches shall be protected by ¼-inch asbestos board covered with not less than No. 22 USSG galvanized sheet iron or nonferrous metal. A dead air space of ¼ inch shall be left between the protecting asbestos and the wood, and a clearance of not less than 2 inches maintained between the manifold and the surface of such protection.

(d) *Exhaust pipe.* (1) The exhaust pipe shall be gastight and the installation shall comply with one of the following requirements:

(i) All of the engine cooling water shall be discharged through the exhaust pipe when water cooled and shall enter the exhaust pipe at a point as near to the manifold as practicable.

(ii) A length of not less than 12 diameters of the exhaust pipe adjacent to the manifold shall be water-jacketed and cooled in the same manner as the manifold. The remainder of the pipe shall be kept clear of internal woodwork at least 1½ inches.

(iii) Woodwork within 6 inches of any part of the exhaust pipe shall be protected by ¼-inch asbestos board covered with not less than No. 22 USSG galvanized sheet iron or nonferrous metal. A dead air space of ¼ inch shall be left between the protecting asbestos and the wood, and a clearance of not less than ½ of its diameter shall be maintained between the pipe and the surface of such protection.

(2) In all of the above cases described in subparagraph (1) of this paragraph, the exhaust pipe shall be properly supported by noncombustible hangers or blocks and protective gratings shall be provided at such locations where persons or gear might come in contact therewith. Arrangements shall be made to provide access to the exhaust pipe throughout its length. A spark arrester shall be installed in each exhaust line.

(3) Where exhaust lines pass through watertight bulkheads, noncombustible packings shall be installed. Exhaust piping shall be led to the point of escape without traps and with a minimum number of bends or elbows in order to reduce the effect of back pressure.

(4) Where flexibility is necessary, a section of flexible metallic hose may be used. Suitable non-metallic hose may be used if the exhaust is watercooled.

**§ 57.10–10 Diesel engine installations.**

(a) The requirements of § 57.10–5 (a), (c) and (d) shall apply to diesel engine installations.

(b) On installations of engines of the semi-diesel or hot-bulb type, woodwork within 3 feet of starting torches shall be protected by at least ¼-inch asbestos board covered with sheet metal and a dead air space of at least ¼ inch between the asbestos board and the wood.

**§ 57.10–15 Gas turbine installations.**

(a) The design, construction, workmanship and tests of gas turbines and their associated machinery shall be at least equivalent to the standards of the American Bureau of Shipping or other recognized classification society.

(b) The materials used for gas turbine installations shall have properties suitable for the intended service. When materials not conforming to standard A.S.T.M. specifications are employed, data concerning their properties including high temperature strength data where applicable, shall be furnished.

(c) (1) Gas turbine exhaust piping will be considered to be Class II piping under the provisions of § 55.01–1 of this subchapter, except for installations where the exhaust pressure exceeds 150 p.s.i., such as in closed cycle systems. Where exhaust ducting is employed, the drawings and design data shall be submitted to substantiate its suitability and safety for the intended service.

(2) Where considered necessary, gas turbines and associated exhaust systems shall be suitably insulated or cooled, by means of lagging, water jacketing, water spray, or a combination thereof.

(3) Where specifically approved by the Commandant, exhaust lines of gas turbines may be interconnected with boiler uptakes, provided dampers or other suitable devices are provided to prevent backflow of boiler exhaust gases into the turbine.

(d) The air inlet shall be designed and equipped as necessary for the safety of personnel and to prohibit the entrance of harmful foreign material, including water, into the system.

(e) The noise level in the vicinity of any part of the installation shall be kept at or below the levels as prescribed in Department of the Navy, Bureau of Ships' Specifications, Section S1–10, or other approved standards.

(f) Means shall be provided for circulating air, either natural or forced, through the engine compartment for cooling and ventilation.

(g) (1) The control system shall be designed for automatic shutdown of the engine under the following conditions:

(i) Overspeed.

(ii) Excessive exhaust gas temperature.

(iii) Excessive lubricating oil temperature.

(iv) Low lubricating oil pressure.

(2) Audible or visible alarms shall be provided in the gas temperature control system and in the lubricating oil control system. Such alarms shall be actuated prior to or upon automatic shutdown.

(3) A remote, manually operated shutdown device shall be provided. Such device may be totally mechanical or may be electrical with a manually actuated switch.

(h) Drawings and design data of the following components shall be submitted to substantiate their suitability and safety for the service intended:

(1) Combustion chamber.

(2) Regenerator or recuperator.

(3) Casing or piping conveying the gas from the combustion device to the gas turbine.

(i) Gas turbine fuel systems shall meet, in general, the requirements of Part 55 of this subchapter.

## Subpart 57.20—Refrigerating Machinery

**§ 57.20–1 Installation of refrigerating machinery.**

(a) Where refrigerating machines are installed in which anhydrous ammonia is used as a refrigerant, such machines shall be located in a well-ventilated, isolated compartment, preferably on the deck, but in no case shall it be permissible to install such machines in the engineroom space unless it is vented and isolated so as to eliminate any hazard from gas escaping to the engineroom. Absorption machines using a solution of aqua ammonia and machines using carbon anhydride ($CO_2$ gas) are exempt from this requirement, provided the maximum charges that might be released in the event of breakage do not exceed 300 pounds.

(b) Machinery compartments containing equipment for ammonia shall be fitted with a sprinkler system providing an effective water spray and having a remote control device located outside the compartment.

(c) All refrigeration compressor spaces shall be effectively ventilated and drained and shall be separated from the insulated spaces by watertight bulkhead, unless otherwise approved.

**§ 57.20–5 Small portable, self-contained units.**

The requirements of this subpart shall not apply to small, portable, self-contained units.

## Subpart 57.25—Steering Apparatus

**§ 57.25–1 Steering apparatus; existing installations.**

(a) All existing vessels subject to inspection by the Coast Guard shall be provided with suitable steering apparatus. Extra steering apparatus consisting of relieving cables, or of auxiliary power- or hand-steering gear attached to the rudder stock independent of the regular steering gear, shall be provided.

(b) Replacements of steering apparatus on existing vessels shall be in accordance with this subpart for new installations.

**§ 57.25–5 Steering apparatus; new installations.**

(a) All new vessels subject to inspection by the Coast Guard, except certain towed barges, shall be provided with main and auxiliary steering apparatus in accordance with §§ 57.25–10 to 57.25–70, inclusive.

(b) The main steering gear shall be of adequate strength and of sufficient capacity to steer the vessel at maximum service speed. The main steering gear and rudder stock shall be so designed that they are not damaged at maximum astern speed.

(c) The auxiliary steering gear shall be independent of the main steering gear and shall be of adequate strength and of sufficient capacity to steer the vessel at navigable speed and capable of being brought speedily into action in an emergency.

(d) When the steering gear is power operated, the exact position of the rudder shall be indicated at the main steering station.

**§ 57.25–10 Rudder movement.**

(a) The main steering gear shall be capable of putting the rudder over from 35 degrees on one side to 35 degrees on the other side with the vessel running ahead at the maximum continuous rated shaft R.P.M. The timing may be conducted from 35 degrees on one side through 30 degrees on the other side, and the average rate of the rudder shall be not less than 2⅓ degrees per second.

(b) The auxiliary steering gear where power-driven shall be capable of putting the rudder over from 15 degrees on one side to 15 degrees on the other side in 60 seconds with the vessel running ahead at half speed, or 7 knots, whichever is greater.

**§ 57.25–15 Plan approval.**

(a) General arrangement plans of the main and auxiliary steering arrangements and piping systems shall be submitted to the Commandant (MMT), U.S. Coast Guard, Washington, D.C., 20226, for approval.

**§ 57.25–20 Power-driven steering gear.**

(a) The main steering gear shall be power-driven for vessels over 250 feet in length or when the required upper rudder stock diameter is over 9 inches. However, power-driven main steering gear shall be required for any vessel where the hand steering gear is not considered capable of effectively complying with the requirements of § 57.25–10.

(b) The auxiliary steering gear shall be power-driven when the required upper rudder stock diameter is over 9 inches for passenger vessels and over 14 inches for cargo vessels.

**§ 57.25–25 Auxiliary means of steering.**

(a) An auxiliary means of steering will not be required where the main gear is of the dual-power hydraulic type, having two independent pumps and connections and separate leads to the pump prime movers from the source of power, and each independent steering gear power-unit has the required capacity for a main steering gear in order to meet the requirements of § 57.25–10(a). In such cases the attachment to the rudder stock shall be designed for strength in excess of that of the rudder stock.

(b) A suitable arrangement of block and tackle will be acceptable as an auxiliary steering means, and when arranged for operation by means of power-driven winches or similar machinery, will be considered an auxiliary power steering gear.

(c) An auxiliary means of steering will not be required on double-ended ferryboats where independent steering gears are fitted at each end of the vessel, and two sources of power are provided where the gear is power-driven.

**§ 57.25–30 Steadying the rudder.**

(a) All oceangoing vessels requiring power gears shall be provided with arrangements for steadying the rudder in the event of an emergency and when a change of gear is required. On hydraulic type steering gears a suitable arrangement of stop valves in the main piping may be considered as a means of steadying the rudder.

**§ 57.25–35 Rudder stops.**

(a) Main power steering gear shall be provided with positive arrangements for stopping the gear before the rudder stops are reached. These arrangements shall be synchronized with the rudder stock or the position of the gear itself, rather than with the steering gear control system.

(b) Strong and effective rudder stops are to be fitted. Where adequate positive stops are provided within the gear, structural stops wil not be required.

**§ 57.25–40 Buffers.**

(a) On vessels in ocean, coastwise, and Great Lakes service, steering gears other than the hydraulic type shall be designed with suitable buffer arrangements to relieve the gear from shocks to the rudder.

**§ 57.25–45 Pilothouse steering gear controls.**

(a) Control of the main steering gear shall be provided from the pilothouse by mechanical, hydraulic, electrical, or other approved means. The arrangement of the control system and steering gear components shall provide full followup control of the rudder. Supplementary steering control not employing full followup may also be provided from the pilothouse.

(b) Any power required for the pilothouse steering control systems shall be supplied from the steering gear room. Means shall be provided in the steering gear room to disconnect the steering control system from the power source.

**§ 57.25–50 Alternative steering station steering gear controls.**

(a) An alternative steering station shall be provided from which control of the main steering gear can be effected by mechanical, hydraulic, electrical, or other approved means. The alternative steering station shall be located on the after weather deck unless duplicate pilothouse control means are provided in accordance with § 57.25–55. The arrangement of the alternative steering control system and the steering gear components shall provide full followup control of the rudder unless a suitable rudder angle indicator is provided at the alternative steering station.

(b) Means shall be provided to enable orders to be transmitted from the pilothouse to the alternative steering station.

(c) Components of the alternative steering station control system shall be completely separate and independent of the pilothouse steering control system. The shafting, piping, or electrical cable associated with the control means at the alternative steering stations shall be run as widely separated as practicable from the shafting, piping, or electrical cable of the pilothouse steering control systems.

(d) Any power required for the alternative steering control means shall be supplied from the steering gear room. Means shall be provided in the steering gear room to disconnect the alternative steering means from the source of power and, if necessary, from the associated steering gear.

(e) Where it is not practicable to comply with the requirements of this section because of the arrangement of the vessel or the type of steering gear installed, other types of steering gear control systems may be considered. Such systems shall provide steering gear control equivalent to that required by this section. Ease of maintenance, accessibility, and location and arrangement of components, as well as the type of control system, will be among the factors evaluated when determining equivalency.

**§ 57.25–55 Duplicate pilothouse steering gear controls systems.**

(a) Two separate and independent steering control systems shall be provided for controlling the steering gear from the pilothouse when the alternative steering means is not located on the after weather deck.

(b) Duplicate pilothouse steering gear controls, when installed, shall comply with the following requirements:

(1) Where the steering gear is power-driven, the arrangements of the equipment shall be such that full followup control of the rudder is provided with either of the control systems in use. Supplementary steering control not employing followup may be incorporated.

(2) Means shall be provided in the pilothouse to select either of the two con-

trol systems to be in control of the rudder. An "off" position which will disconnect power to both systems may be provided in the pilothouse. Interlocks shall be provided for this control system selector so that only one may be in use at a time.

(3) Any power required for the pilothouse steering control systems shall be supplied from the steering gear room. Means shall be provided in the steering gear room to disconnect remote steering gear control systems from the source of power.

(4) The shafting, piping, or electric cables of the two pilothouse steering control systems shall be run as widely separated as practicable throughout their length between the pilothouse and the steering gear room.

(c) Where only the main steering gear is power-driven, arrangements shall be such that either steering control system may be connected to control the main steering gear. Where both the main and auxiliary steering gears are power-driven, one steering control system shall control the main steering gear and the other shall control the auxiliary steering gear.

(d) For dual-power hydraulic type steering gears, of such a type that an auxiliary means of steering is not required, one control system shall control one hydraulic unit and the other control system shall control the other hydraulic unit.

**§ 57.25–60 Arrangement of steering wheels.**

(a) Steering wheels, including "trick wheels" which are used as the alternative steering means, shall turn in a clockwise direction for "right rudder" and counterclockwise for "left rudder." The ship's heading shall be to the right, following clockwise movement of the wheel.

(b) The arrangement of steering stations shall be such that the helmsman is abaft the wheel. However, if a wheel is fitted in the steering gear room, and is intended solely for warming up and testing the gear, the helmsman need not stand abaft the wheel. The rims of the wheels shall be plainly marked with arrows and lettering for right and for left rudder, or a suitable notice indicating these directions shall be posted directly in the helmsman's line of vision.

**§ 57.25–65 Special steering apparatus.**

(a) Where no regular rudder is fitted and steering action is obtained by a change of setting of the propelling unit, auxiliary steering is not required, nor will the requirements of this subpart be generally applicable. Special consideration will be given by the Commandant for such installations.

(b) When tiller bars instead of wheels are installed in the pilothouse, they shall be fore and aft when the rudders are amidships. A pointer shall be fitted to the forward end of the bar which shall point directly ahead when the rudders are amidships, and shall point to the right when the bow of the ship moves to the right, and shall point to the left when the bow of the ship moves to the left.

**§ 57.25–70 Steering gear piping.**

(a) The arrangement of piping for hydraulic steering gears shall be such that a change from the main to the auxiliary gear can be readily effected.

(b) A relief valve shall be provided for the protection of the hydraulic system.

(c) Pressure piping shall meet the requirements of Part 55 of this subchapter.

## Subpart 57.30—Nuclear Energy

AUTHORITY NOTE: The provisions of this Subpart 57.30 also interpret or apply R.S. 4472, as amended, sec. 2, 23 Stat. 118, as amended, secs. 2, 633, 63 Stat. 496, 545; 46 U.S.C. 170, 2, 14 U.S.C. 2, 633. Treasury Department Order 167–17, June 29, 1955, 20 F.R. 4976.

**§ 57.30–1 Scope.**

(a) The requirements in this subpart apply to all installations, systems, and components thereof, utilizing nuclear energy for propulsion or for any other purpose, or handling radioactive materials other than as cargo.

(b) The regulations covering the transportation and handling of radioactive materials as cargo are contained in Part 146 of Subchapter N (Dangerous Cargoes) of this chapter.

**§ 57.30–5 Definitions.**

(a) The term "nuclear vessel" means any vessel in which power for propulsion, or for any other purpose, is derived from nuclear energy; or any vessel handling or processing substantial amounts of radioactive material other than as cargo.

(b) The term "nuclear energy" means all forms of energy released by nuclear fission or radioactive decay, or by any other form of nuclear transformation.

(c) The term "radioactive material" means any material or combination of materials that spontaneously emits ionizing radiation.

**§ 57.30–10 General safety requirements.**

(a) The reactor installation shall be designed to take into account the special conditions of service on board the vessel both in normal and exceptional circumstances of operation.

(b) Prior to the issuance of a certificate of inspection by the U.S. Coast Guard for a nuclear vessel, it shall be shown to the satisfaction of the Commandant that:

(1) The vessel provides a degree of safety for the non-nuclear portion at least equivalent to the relevant requirements prescribed in this chapter for a conventionally-powered ocean-going passenger vessel of similar size, capacity, and tonnage. In this respect components and systems such as watertight subdivision, stability, fire protection, bilge pumping arrangements, fire extinguishing arrangements, electrical installations, steering gear, astern power, and navigational aids will be evaluated in order to provide for the maximum practicable safety for the vessel.

(2) The vessel complies with such additional requirements as may be prescribed by the Commandant and with the requirements of the Atomic Energy Commission.

(3) The design, construction and operation of the vessel do not create an unreasonable radiation, or other hazard, at sea or in port, to the crew, passengers, or public or to the waterways or food or water supply.

(4) The nuclear systems or components thereof are provided with means for preventing the uncontrolled release of hazardous amounts of radioactive material to normally accessible spaces or to the ship's environment in the event of accident or malfunctioning of the nuclear system.

(5) The vessel has standby and emergency components essential to its safe operation in order to provide maximum protection in the event of an accident or malfuctioning of the nuclear system.

(c) A license or other certificate issued by the Atomic Energy Commission may be accepted by the Commandant as evidence that the vessel complies with the requirements of the Atomic Energy Commission and subparagraph (b) (3) and (4) of this section.

**§ 57.30–15 Special operating procedures.**

(a) In addition to the requirements specified in this chapter, all nuclear vessels may be subject to additional requirements governing fueling, start-up, and operation.

**§ 57.30–20 Inspection, overhaul, and repairs.**

(a) Every nuclear vessel subject to the regulations in this subchapter shall be inspected by the U.S. Coast Guard at least annually to ascertain that the hull, nuclear systems, machinery, equipment, appliances, etc., of the vessel comply with the regulations in this chapter.

(b) In addition to the requirements for inspection, test, overhaul and repair specified in this chapter, nuclear vessels may be subject to such additional requirements as may be prescribed by the Commandant for inspection, test, overhaul and repair.

**§ 57.30–25 Radiation protection.**

(a) The Standards for Protection Against Radiation set forth in 10 CFR Part 20 will be the radiation protection standards followed by the U.S. Coast Guard, except as otherwise provided for by law.

**§ 57.30–30 Safety Assessment.**

(a) A "Safety Assessment" shall be prepared to permit evaluation of the nuclear powerplant and safety of the vessel to ensure compliance with § 57.30–10(b)(3).

(b) The "Safety Assessment" shall be submitted to the Commandant for approval and shall always be kept up-to-date.

(c) The "Safety Assessment" will be used as a basis for establishing orderly negotiations between the United States and governments of countries which a nuclear vessel intends to visit to permit entry of nuclear ships into ports of different countries.

§ 57.30–35 Operating Manual.

(a) A fully detailed "Operating Manual" shall be prepared for the information and guidance of the operating personnel in their duties on all matters relating to the operation of the nuclear powerplant and having an important bearing on safety.

(b) The "Operating Manual" shall be submitted to the Commandant for approval and shall always be kept up-to-date.

(c) A copy of the "Operating Manual" shall be kept on board the vessel at all times.

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# PART 58—REPAIRS TO BOILERS, UNFIRED PRESSURE VESSELS AND APPURTENANCES

Subpart 58.01—General Requirements

Sec.
58.01–1 Scope.
58.01–5 Repairs, replacements, or alterations.

Subpart 58.05—Welding Repairs to New Pressure Vessels

58.05–1 Welding repairs when plate defects develop or are discovered during fabrication.

Subpart 58.10—Welding Repairs to Boilers and Unfired Pressure Vessels in Service

58.10–1 Scope.
58.10–5 Cracks.
58.10–10 Corroded surfaces.
58.10–15 Rivets and staybolts.
58.10–20 Patches in shells and tube sheets.
58.10–25 Stayed areas.
58.10–30 Seal welding.
58.10–35 Wrapper plates and back heads.

Subpart 58.15—Miscellaneous Boiler Repairs

58.15–1 Furnace repairs.
58.15–5 Stayed furnaces and combustion chambers.
58.15–10 Bagged or blistered shell plates.

Subpart 58.20—Welding Repairs to Castings

58.20–1 Welding repairs to defective carbon-steel castings.
58.20–5 Welding repairs to defective alloy-steel castings.

AUTHORITY: The provisions of this Part 58 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426–4431, as amended, 4433, as amended, 4434, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404–409, 411, 412, 435, 481, 489, 366, 395, 363, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857.

## Subpart 58.01—General Requirements

### § 58.01–1 Scope.

The regulations in this part apply to the repairs of all boilers, unfired pressure vessels and appurtenances subject to inspection by the Coast Guard.

### § 58.01–5 Repairs, replacements, or alterations.

(a) No repairs, replacements or alterations, except emergency repairs, etc., shall be made to machinery boilers, unfired pressure vessels, their mountings or internal fittings, safety valves, piping systems, or pressure appliances without prior approval by the Officer in Charge, Marine Inspection.

(b) Emergency repairs, replacements, or alterations shall be reported as soon as practicable to the Officer in Charge, Marine Inspection, at or nearest the first port where the vessel may call after such repairs are made.

(c) Repairs, replacements, or alterations to installations in service shall so far as practicable be made with materials and in the manner specified for new construction.

## Subpart 58.05—Welding Repairs to New Pressure Vessels

### § 58.05–1 Welding repairs when plate defects develop or are discovered during fabrication.

(a) *Cracked plates.* Plates which crack during cold forming operations as a result of localized stress raisers such as sharp plate edges, minor localized surface imperfections, and fractures which subsequent microstructure shows to be caused by coarse grain size may be repaired if authorized by the Commandant. Prior to such repairs being authorized, information shall be furnished as follows:

(1) Heat treatment to be employed prior to undertaking repairs.

(2) Method of excavating defective material and type of groove to be employed.

(3) Method of examining excavation to insure that all defective material has been removed.

(4) Welding procedure to be employed in effecting the repair.

(5) Heat treatment to be employed during and after welding.

(6) Type of nondestructive test to be made to insure that repair is satisfactory.

(b) *Laminations.* Laminations or inclusions in the plate which initially appear in the heat affected zone during welding operations or appear during the drilling of tube holes may be repaired if authorized by the Commandant. Prior to such repairs being authorized information shall be furnished as follows:

(1) Method of excavating defective material and type of welding groove to be used if any.

(2) Method of examining excavation to insure that all defective material has been removed.

(3) Welding procedure to be employed in effecting repair.

(4) Heat treatment to be employed during and after welding.

(5) Type of nondestructive test to be made to insure that repair is satisfactory.

## Subpart 58.10—Welding Repairs to Boilers and Unfired Pressure Vessels in Service

### § 58.10–1 Scope.

(a) Repairs to boilers or unfired pressure vessels in service may be performed by welding provided the welding meets the applicable requirements of Part 56 of this subchapter. No repairs by welding shall be made, except temporary emergency repairs, without the prior approval of the Officer in Charge, Marine Inspection. Emergency repairs shall be replaced with permanent repairs meeting the requirements of this subchapter when the vessel returns to a port in which an Officer in Charge, Marine Inspection, is located, except in the case of minor repairs which in the opinion of the Officer in Charge, Marine Inspection, do not materially affect the safety of the boiler or pressure vessel.

(b) Repair welding of power boilers not meeting requirements for class I welded pressure vessels is prohibited unless the stress is carried by such other type(s) of construction complying with the requirements of this subchapter, and where the adequacy of the boiler design is not solely dependent upon the strength of the welds.

(c) Only welded repairs as specified in this subchapter are permitted on boilers and unfired pressure vessels. The welding repairs allowed by this subpart apply only to boilers and unfired pressure vessels fabricated of carbon steel. Welding repairs to boilers and unfired pressure vessels fabricated of alloy steel will be given special consideration by the Commandant. Such other method of repairs by means of welding not covered in this subchapter shall be referred to the Commandant and may be authorized by him if, in his opinion, it meets the intent of this subchapter.

### § 58.10–5 Cracks.

(a) Cracks extending from the calking edge of plates to the rivet holes of circumferential joints may be welded provided the cracks are veed out so that complete penetration of the weld metal is secured.

(b) Circumferential cracks from rivet hole to rivet hole in girth joints may be welded provided there are not more than three consecutive cracked ligaments nor more than a total of six cracked ligaments in any one girth joint.

(c) Cracks in staybolted plates may be welded provided they are located entirely within staybolted areas and the total length of any crack or series of consecutive cracks does not exceed two staybolt pitches.

(d) Cracks in plain, circular or Adamson ring or similar type furnaces may be welded provided any one crack does not exceed 12 inches in length and after completion the weld is stress-relieved as required by § 56.01–70 of this subchapter. Cracks in corrugated furnaces may be repaired by welding provided any one crack does not exceed 20 inches in length.

(e) Fire cracks may be welded at riveted door openings extending from

the edge of the plate, but not more than 2 inches beyond the centerline of the rivet holes.

(f) Cracks may be welded between tube holes in the shell of water-tube boiler drums, provided there are not more than two cracks in any one row in any direction, nor more than a total of four cracks in a drum, and further provided the welding meets the requirements of this subchapter for class I welded pressure vessels and is approved by the Commandant.

(g) All cracks permitted to be repaired under this subpart shall be excavated to sound metal by grinding, flame gouging or chipping out the defective metal to form a clean welding groove. The first two methods of excavation are preferable. Either a V groove or U groove wherein complete penetration of the weld metal is secured may be used. After excavation is completed and prior to welding, the excavated area shall be examined by magnetic particle testing to insure that the entire crack was excavated. When the reverse side of the weld is accessible the root of the weld shall be chipped or ground out to insure a clean surface of the originally deposited metal and the resultant groove welded to obtain a sound weld having complete penetration. During welding a preheat of 200 degrees plus or minus 50 degrees F. shall be maintained by controlled temperature. For thicknesses exceeding ¾ inch, suitable U grooves should be employed. A welding sequence shall be used so as to equalize welding stresses.

(h) After cracks originating in tube or rivet holes are repaired by welding, the holes shall be properly reamed and the weld reinforcing ground flush with the plate in way of rivet heads.

(i) Flat tube sheets in fire-tube boilers which have corroded or where cracks exist in the ligaments may be repaired by welding.

(j) The welding repairs to drums of power boilers, except as otherwise permitted in this subpart, is prohibited.

### § 58.10–10 Corroded surfaces.

(a) Corroded surfaces in the calking edges of circumferential seams may be built up by welding to the original thickness under the following conditions:

(1) The thickness of the original metal to be built up between rivet holes and calking edge shall not be less than one-fourth of the diameter of the rivet hole, and the portion of the calking edge to be thus reinforced shall not exceed 30 inches in length in a circumferential direction.

(2) In all repairs to circumferential seams by welding, the rivets shall be removed over the portions to be welded for a distance of at least 6 inches beyond the repaired portion.

(3) After repairs are made the rivet holes shall be reamed before the rivets are re-driven.

(b) It is not permissible to build up or reinforce a grooved or corroded area of unstayed internal surfaces by means of welding, except that widely scattered pit holes may be built up by welding.

(c) Where external corrosion has reduced the thickness of flat plates around hand holes to an extent of not more than 40 percent of the original thickness and for a distance not exceeding 2 inches from the edge of the hole, the plate may be built up by welding.

(d) Where stayed sheets have corroded to a depth not exceeding 40 percent of their original thickness, they may be reinforced or built up by welding. Where the staybolts are fitted with riveted heads, the staybolts in the reinforced area shall be renewed in accordance with the provisions of Subparts 52.30 and 52.35 of this subchapter, but where the staybolts are fitted with nuts, the nuts may be removed and after reinforcing has been applied, collars may be welded around the staybolts in lieu of the nuts. Such reinforced areas shall not exceed 400 square inches nor more than 30 inches in one direction. Two such areas in any one plate may be reinforced: *Provided*, That the distance between the reinforced surfaces is not less than 30 inches.

(e) When the corroded portion of a staybolted surface exceeds 400 square inches, it is permissible to repair the same by cutting out the defective portion and replacing it with a new plate, the edges of the new plate to be welded in position. In such cases, new staybolts shall be fitted in accordance with the requirements of Subparts 52.30 and 52.35 of this subchapter and where welding is performed through a line of staybolts, welded collars as required by Figure 52.35–1 of this subchapter shall be used to attach the staybolts.

### § 58.10–15 Rivets and staybolts.

(a) It is not permitted to reinforce or build up by welding the heads of rivets or staybolts that have deteriorated. Such rivets or staybolts shall be replaced. The seal welding of rivet heads to secure tightness is prohibited.

(b) Where leaks develop around staybolts which are otherwise in good condition, the nuts may be replaced with a beveled collar formed around the end of the stay by means of welding. In such cases, the depth of collar measured on the stay and the width measured on the plate, shall be equal to one-half the diameter of the staybolt. (See Figure 52.35–1 of this subchapter.)

### § 58.10–20 Patches in shells and tube sheets.

(a) Unreinforced openings in the shells or drums of boilers or pressure vessels, the diameter of which does not exceed the maximum diameter of an unreinforced opening, in accordance with § 52.25–15 of this subchapter, may be closed by the use of a patch or plate inside the drum or shell and sealed against leakage by welding. Such plates shall have a diameter of at least 2 inches larger than the diameter of the hole and shall have a thickness equal to the thickness of the plate to which it is attached. It is not permissible to insert such patches in the shell or head flush with the surrounding plate unless the requirements of this subchapter for Class I welded pressure vessels are met.

(b) Portions of tube sheets which have deteriorated may be renewed by replacing the wasted portion with a new section. The ligaments between the tube holes may be joined by means of welding and staytubes, or other acceptable means of lowering the stress on the repaired section may be installed if in the judgment of the Officer in Charge, Marine Inspection, it is necessary.

(c) The edge preparation and preheat of butt-welded joints employed in the renewal of defective or corroded boiler plates shall comply with the requirements of § 58.10–5 (g).

### § 58.10–25 Stayed areas.

Welding repairs are permitted in staybolted areas or areas adequately stayed by other means so that should failure of the welds occur the stress will be carried by the stays. The welds shall be located entirely within staybolted areas which prohibit welds passing through the outer row of stays.

### § 58.10–30 Seal welding.

Where leaks occur in riveted joints or connections, they shall be carefully investigated to determine the cause. Such leaks may be made tight by seal welding the edge, if, in the opinion of the Officer in Charge, Marine Inspection, this will make a satisfactory repair.

### § 58.10–35 Wrapper plates and back heads.

Wrapper plates and back heads may be renewed in whole or repaired as follows:

(a) Wrapper plates or back heads shall be cut between two rows of staybolts or on a line of staybolts where the thickness is approximately the same as the original construction. If welding is employed on a line of staybolts, the staybolts shall be fitted with a welded collar as required in Figure 52.35–1 of this subchapter.

(b) The edges of wrapper plates riveted to tube sheets and back heads shall be removed by cutting out the rivets.

(c) The edges of existing plates and new plates shall be beveled by chipping, flame cutting, or grinding so as to form a suitable groove whereby complete penetration of the weld metal will be obtained. The edge preparation and preheat shall comply with the requirements of § 58.10–5 (g).

(d) The edges of the new plate shall be butt-welded and the plate shall be riveted to the flanges of the tube sheet and back heads and the staybolts renewed.

(e) Sections of wrapper plates of combustion chambers outside of stayed areas may be repaired by welding provided the welded joints are stress-relieved by means of controlled heat and the joints are nondestructively tested.

## Subpart 58.15—Miscellaneous Boiler Repairs

### § 58.15–1 Furnace repairs.

(a) Where corrugated or plain furnaces or flues are distorted 1½ inches or

more, they shall be repaired by either of the following methods:

(1) The furnace shall be forced back to a true circular shape, and the Officer in Charge, Marine Inspection, may require strong-backs or other acceptable means of support to hold the furnace from future collapse, if in his opinion such support is necessary; or,

(2) The furnace shall be adequately stayed as found necessary in the judgment of the Officer in Charge, Marine Inspection.

(b) Distortion means the difference between any single measured diameter of the furnace and the diameter of a true circle at the same location. The diameter of the true circle may be taken as the original furnace diameter or may be determined by a means acceptable to the Officer in Charge, Marine Inspection.

(c) Where the distortion does not exceed 1½ inches it will not be necessary to force the furnace back to a true circle if the allowable pressure is reduced in the ratio of 1½ percent for each 1/10 of an inch of distortion. However, if the maximum distortion does not exceed one inch and the length of the distorted area is not more than three corrugations, or if the maximum distortion does not exceed ¾ inch for a length greater than three corrugations of distorted area, the repairs or reduction in pressure will not be required unless considered necessary by the marine inspector.

(d) When it becomes necessary to rivet a patch to a furnace or other part of the heating surface, the riveted patch shall be placed on the water side of the plate in order not to form a pocket in which sediment may collect.

(e) Furnace crowns which have become distorted, not in excess of the limitations provided in paragraph (c) of this section, may be repaired by pumping back the distorted section to as nearly a true circle as possible and reinforcing the same by means of a ring, arc- or gas-welded to the distorted corrugation as shown in Figure 58.15–1 (e), the welding to be done by qualified welders using acceptable welding electrodes in accordance with § 56.01–20 of this subchapter.

### § 58.15–5 Stayed furnaces and combustion chambers.

(a) Where the plate forming the walls of stayed furnaces or combustion chambers becomes bulged between staybolts, repairs may be made by inserting an additional staybolt in the center of such space supported by the four staybolts.

(b) Where it is desired to rivet a patch to the wall of a stayed furnace or combustion chamber, the defective portion of the plate shall be cut away until solid material is reached, the patch shall be riveted on the water side, and the staybolts renewed, and extended through the new plate.

### § 58.15–10 Bagged or blistered shell plates.

(a) When the shell plates of cylindrical boilers which are exposed to the radiant heat of the fire become bagged or blistered, it shall be the duty of the chief engineer in charge of the vessel to notify the Officer in Charge, Marine Inspection, for examination before raising steam on the boiler.

(b) Where the shell plate is bagged due to overheating, the Officer in Charge, Marine Inspection, may, if in his judgment it is practicable, permit the same to be driven back to its original position.

(c) Where the shell plate has blistered, bagged, or bulged to such an extent that there is an appreciable thinning of the plate, the Officer in Charge, Marine Inspection, shall require the defective portion to be cut away and the shell repaired by fitting a patch of steel plate conforming to the requirements of Subpart 51.04 of this subchapter in place of the defective portion, care being taken that the riveting schedule of the patch is so arranged as to give the plate sufficient strength to withstand the stress placed on it in service.

## Subpart 58.20—Welding Repairs to Castings

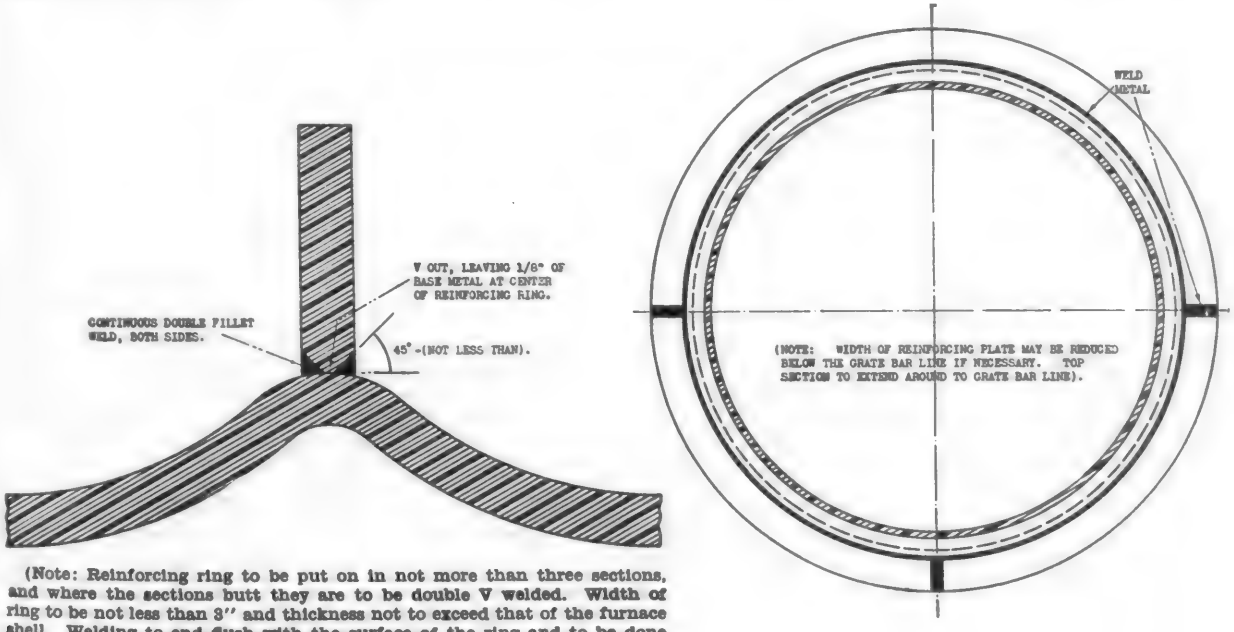
### § 58.20–1 Welding repairs to defective carbon-steel castings.

(a) Defects in carbon-steel castings, such as valve bodies, pipe fittings, channels, covers, manifolds, and other pressure-containing appliances, may be repaired by arc or gas welding.

(b) Defects in carbon-steel castings shall be classed as follows:

(1) *Minor defects.* Minor defects are undersized defective areas resulting from oxyacetylene cutting, grinding, or chipping during cleaning operation, surface sand or slag defects or other slight surface defects except cracks or cold shuts. The excavated depth of a minor defect shall not exceed 20 percent of the wall thickness or 1 inch, whichever is the lesser. No lineal dimension shall exceed four times the wall thickness or be greater than 6 inches, whichever is the lesser.

(2) *Major defects.* All defects exceeding the depth or size given in subparagraph (1) of this paragraph shall be considered a major defect, which shall


V OUT, LEAVING 1/8" OF BASE METAL AT CENTER OF REINFORCING RING.
CONTINUOUS DOUBLE FILLET WELD, BOTH SIDES.
45°-(NOT LESS THAN).
WELD METAL
(NOTE: WIDTH OF REINFORCING PLATE MAY BE REDUCED BELOW THE GRATE BAR LINE IF NECESSARY. TOP SECTION TO EXTEND AROUND TO GRATE BAR LINE).

(Note: Reinforcing ring to be put on in not more than three sections, and where the sections butt they are to be double V welded. Width of ring to be not less than 3" and thickness not to exceed that of the furnace shell. Welding to end flush with the surface of the ring and to be done by a welding operator duly qualified.)

FIGURE 58.15–1 (e)—Approved method of reinforcing furnace crowns by means of arc or gas welding.

be repaired in the same manner as a minor defect. Repairs of major defects shall be nondestructively tested as required by paragraph (h) of this section.

(c) Prior to any welding being done, all defective material shall be removed until the base metal is shown to be sound. Defective areas of castings may be removed by chipping, grinding, drilling, or oxyacetylene grooving to a sufficient depth to insure that the remaining base metal is shown to be sound by acid etching, radiography, or magnetic particle testing. The latter methods of testing are preferred. Any slag remaining after oxyacetylene grooving shall be completely removed by chipping or grinding. When defects are removed by drilling, the resulting hole shall be countersunk to a depth of at least 25 percent of the metal thickness with a bevel of the included angle being not less than 45 degrees.

(d) Prior to any welding being done, the cavity and the adjoining area shall be preheated to a temperature suitable for the chemical elements and thickness of metal involved which experience indicates is satisfactory. Castings shall be preheated to a temperature which experience indicates is suitable for the chemical elements and thickness of the casting when lugs, supports, ribs, or bosses are to be welded thereto.

(e) Castings other than those which have been repaired for minor surface defects, the excavated dimensions of which do not exceed the limitations specified by subparagraph (b) (1) of this section, shall be stress-relieved in a furnace to a temperature of from 1,100° F. to 1,200° F. for 1 hour per inch of maximum thickness and allowed to cool in the furnace to 500° F. before removal.

(f) Filler metal used in the repair of defective steel castings shall be acceptable electrodes in accordance with § 56.01–20 of this subchapter and shall meet the chemical and physical properties of the base metal.

(g) The defective material removed shall be replaced using pipe welders qualified in accordance with Qualification Test No. 4 for the position in which the welding is to be done as given in § 56.01–10 of this subchapter. The use of welders qualified to weld plate shall be permitted provided the welding is done in the flat position.

(h) Completed welds shall be inspected for cracks and other defects by magnetic particle testing, and in the case of major repairs, the welded area shall be examined by radiography if the casting is to be used in steam lines subject to boiler pressure, boiler feed, or blowoff lines. Prior to the use of magnetic particle inspection, the welds shall be made smooth and free of grooves or depressions.

(i) After repair of defective castings has been completed a hydrostatic test as prescribed in § 61.30–5 of this subchapter based upon the primary service pressure rating shall be applied.

### § 58.20–5 Welding repairs to defective alloy-steel castings.

Defects in alloy-steel castings may be repaired by arc or gas welding in accordance with the requirements of § 58.20–1, provided the preheat and postheat employed are satisfactory for the material to be welded and process approval tests are conducted. The heat treatment and process approval tests shall be acceptable to the Commandant.

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## PART 59—INDEPENDENT INTERNAL COMBUSTION ENGINE FUEL TANKS

Subpart 59.01—General Requirements

Sec.
59.01–1 Scope.

Subpart 59.05—Gasoline Fuel Tanks

59.05–1 Construction.
59.05–5 Installation.
59.05–10 Tests.

Subpart 59.10—Diesel Fuel Tanks

59.10–1 Construction.
59.10–5 Installation.
59.10–10 Tests.

AUTHORITY: The provisions of this Part 59 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426–4431, as amended, 4433, as amended, 4434, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404–409, 411, 412, 435, 481, 489, 366, 395, 363, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857.

### Subpart 59.01—General Requirements

#### § 59.01–1 Scope.

(a) The regulations in this part contain requirements for independent internal combustion engine fuel tanks, on all vessels subject to inspection by the Coast Guard and on all motorboats and motor vessels of more than 15 gross tons carrying passengers for hire.

(b) Passenger vessels exceeding 100 gross tons constructed prior to July 1, 1935, may carry gasoline as fuel not exceeding 40 gallons to supply the emergency electrical system. Passenger vessels exceeding 100 gross tons constructed on or after July 1, 1935, and all emergency systems converted on or after July 1, 1935, shall use diesel fuel for internal combustion engine units. Such vessels may carry a sufficient quantity of diesel fuel to supply the emergency electrical system.

(c) An outage of 2 percent shall be provided on all fuel tanks containing petroleum products.

### Subpart 59.05—Gasoline Fuel Tanks

#### § 59.05–1 Construction.

(a) Tanks may be of either cylindrical or rectangular form, except that tanks for emergency electrical systems shall be of cylindrical form.

(b) Tanks shall be designed to withstand the maximum head to which they may be subjected in service, except that in no case shall the thickness of the shell or head be less than ⅛ inch.

(c) Tanks shall be constructed of wrought iron, steel or nonferrous material, or corrosion-resistant alloys suitable for the purpose. Tanks constructed of noncorrosion resistant materials less than 3/16 inch in thickness shall be galvanized by the hot-dipped process both inside and outside.

(d) Joints shall be riveted, brazed or welded, except that soldered joints may be used on small tanks of 20 gallons or less capacity, provided the solder used has a melting point of not less than 800° F.

(e) All nozzle connections shall be made to the top of the tank and shall be securely riveted, welded, brazed or soldered to the tank.

(f) No tubular gauge glasses or trycocks shall be fitted to the tanks.

(g) Tanks shall be provided with swash plates and braces, where necessary. The material used shall be the same as the tank.

#### § 59.05–5 Installation.

(a) Gasoline fuel tanks used for propulsion shall be located in watertight compartments separate from, but adjacent to the engineroom or machinery space. Fuel tanks for auxiliaries shall be located on or above the weather deck outside of the engine housing or compartment and as close to the engine as practicable. All tanks shall be so installed as to provide a free circulation of air around the tanks.

(b) Cylindrical tanks with longitudinal seams shall be arranged horizontally where practicable so that such seams are located as near the top as possible.

(c) All tanks shall be securely fastened and shall be arranged as to be readily inspected or movable for inspection. Portable fuel tanks are not permitted.

#### § 59.05–10 Tests.

(a) Tanks vented to atmosphere shall be hydrostatically tested to a pressure of at least 10 pounds per square inch gage after installation.

(b) All tanks not vented to atmosphere shall be constructed and tested in accordance with Parts 54 and 61 of this subchapter.

### Subpart 59.10—Diesel Fuel Tanks

#### § 59.10–1 Construction.

(a) Tanks may be of either cylindrical or rectangular form.

(b) Tanks shall be designed to withstand the maximum head to which they may be subjected in service, except that

in no case shall the thickness of tanks having capacities of 40 gallons or less be less than 1/16 inch, and tanks having capacities over 40 gallons be less than 1/8 inch.

(c) Joints shall be riveted, brazed, or welded, except that soldered joints may be used on small tanks of 20 gallons or less capacity provided that the solder used has a melting point of not less than 800° F.

(d) Tanks shall be provided with swash plates and braces where necessary. The material used shall be the same as the tank.

(e) All nozzles for pipe connections shall be securely riveted, welded, brazed or soldered to the tank. Where liquid level indicating devices are attached to the tank, they shall be of heat resistant materials adequately protected from mechanical damage and provided at the tank connections with devices which will automatically close in the event of rupture of the gage or gage lines.

**§ 59.10–5 Installation.**

(a) Tanks containing fuel for emergency lighting units shall be located on an open deck or in an adequately ventilated metal compartment. No tank shall be located in a compartment where the temperature may exceed 150° F.

(b) When cylindrical tanks are installed, longitudinal seams shall be located as near the top of the tank as possible.

(c) The tanks shall be properly secured and accessible for inspection.

**§ 59.10–10 Tests.**

(a) Tanks vented to atmosphere shall be tested to a hydrostatic pressure of 5 pounds per square inch gage after installation, and at least to the maximum height the liquid may rise in the vent, whichever is greater.

(b) All tanks not vented to atmosphere shall be constructed and tested in accordance with Parts 54 and 61 of this subchapter.

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# PART 61—INSTALLATIONS, TESTS, INSPECTIONS, MARKINGS, AND OFFICIAL FORMS

**Subpart 61.01—General Requirements**

Sec.
61.01–1 Scope.

**Subpart 61.05—Installations**

61.05–1 Scope.
61.05–5 Foundations.
61.05–10 Protection of adjacent structure.
61.05–15 Boiler uptakes.
61.05–20 Machinery guards.
61.05–25 Means of stopping machinery.

**Subpart 61.10—Initial and Periodic Vessel Inspection**

61.10–1 Scope.
61.10–5 Requirements for steam-propelled motorboats.

**Subpart 61.15—Tests and Inspections of Machinery and Equipment**

61.15–5 Tests and inspections of steering gear.
61.15–10 Trial-trip observance.
61.15–15 Tail shaft survey.
61.15–16 Drydock examination.

**Subpart 61.20—Tests and Inspection of Boilers**

Sec.
61.20–1 Boilers under construction.
61.20–5 Preparation of boilers for inspection and test.
61.20–10 New boilers.
61.20–15 Boilers in service.
61.20–20 Boiler mountings and attachments.
61.20–25 Boilers of foreign-built vessels admitted to American registry.

**Subpart 61.25—Tests and Inspections of Pressure Vessels**

61.25–1 Scope.
61.25–3 Welded pressure vessels under construction.
61.25–5 New pressure vessels.
61.25–10 Hydrostatic test of riveted pressure vessels.
61.25–15 Hydrostatic test of welded and brazed pressure vessels.
61.25–16 Pneumatic testing of pressure vessels.
61.25–20 Pressure vessels in service.

**Subpart 61.30—Tests and Inspection of Piping, Valves and Fittings**

61.30–1 Scope.
61.30–5 Shop test.
61.30–10 Installation test.
61.30–15 Piping in service.
61.30–20 Sea chests, sea valves and strainers.

**Subpart 61.35—Proof Hydrostatic Tests**

61.35–1 Hydrostatic tests of boilers and appurtenances to determine pressure rating.
61.35–5 Proportional limit method.

**Subpart 61.40—Markings**

61.40–1 Boilers.
61.40–5 Unfired pressure vessels.

**Subpart 61.45—Official Forms**

61.45–1 Scope.
61.45–5 Form CG–2935; boiler data report; manufacturer's certification.
61.45–10 Form CG–2936; unfired pressure vessel data report; manufacturer's certification.
61.45–15 Form CG–935A; affidavit of manufacturer of class B material or appliances.

AUTHORITY: The provisions of this Part 61 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426–4431, as amended, 4433, as amended, 4434, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404–409, 411, 412, 435, 481, 489, 366, 395, 363, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857.

## Subpart 61.01—General Requirements

**§ 61.01–1 Scope.**

The regulations in this part apply to the installations, tests, inspections, and markings of all boilers, pressure vessels and machinery subject to inspection by the Coast Guard.

## Subpart 61.05—Installations

**§ 61.05–1 Scope.**

The regulations in this subpart apply to the installations of machinery and pressure vessels installed on vessels subject to inspection by the Coast Guard.

**§ 61.05–5 Foundations.**

(a) Drawings showing details of proposed foundations, or saddles, for boilers and the proposed means of bracing boilers in the vessel shall be submitted for approval to the Officer in Charge, Marine Inspection, in the district where the installation is being made.

(b) Provision shall be made in foundations for expansion of the boilers when heated.

(c) Boilers shall be provided with chocks to prevent movement in the event of collision unless a bolted or riveted construction satisfactorily provides for this contingency.

**§ 61.05–10 Protection of adjacent structure.**

(a) Boilers shall be so placed that all parts may be readily accessible for inspection and repair.

(b) In vessels having a double bottom or other extensive surfaces directly below the boiler, as in the case of keels and girders in wooden vessels, the distance between such surface and a boiler shall in no case be less than 8 inches at the lowest part of a cylindrical boiler and not less than 18 inches under the pans of water-tube boilers.

(c) In certain types of vessels where the boiler foundation forms the ash pit, such foundations shall be efficiently ventilated, except in cases where the ash pit is partially filled with water at all times.

(d) The pans of oil-burning, water-tube boilers shall be arranged to prevent oil from leaking into the bilges and shall be lined with firebrick or other heat resisting material.

(e) In vessels constructed of wood or having wood structure adjacent to boilers or uptakes such structure shall be protected by noncombustible, nonconducting material covered with sheet metal, and the distance between the wooden structure and the uptakes and funnels shall in no case be less than 12 inches.

(f) The distance between a boiler and a compartment containing fuel oil shall not be less than 24 inches at the back end of a boiler and 18 inches elsewhere, except that for a cylindrical part of a boiler or a knuckle in the casing of a water-tube boiler, these distances may be reduced to 18 and 12 inches, respectively, provided the requirements of paragraph (a) are complied with.

(g) All oil-burning boilers shall be provided with oiltight drip pans under the burners and elsewhere where necessary to prevent oil draining into the bilges.

**§ 61.05–15 Boiler uptakes.**

(a) Where dampers are installed in the uptakes or funnels, the arrangement shall be such that it will not be possible

to shut off the gas passages from the operating boilers.

(b) All main and auxiliary boilers shall be fitted with separate gas passages from each boiler.

**§ 61.05–20 Machinery guards.**

Gears, couplings, flywheels, and all machinery capable of injuring personnel shall be provided with adequate covers or guards.

**§ 61.05–25 Means of stopping machinery.**

(a) Machinery driving forced and induced draft fans, fuel oil transfer pumps, fuel oil unit pumps and other similar fuel pumps shall be fitted with remote controls from a readily accessible position outside of the space concerned so that they may be stopped in the event of fire occurring in the compartment in which they are located. These controls shall be suitably protected against accidental operation or tampering.

## Subpart 61.10—Initial and Periodic Vessel Inspection

**§ 61.10–1 Scope.**

(a) Initial and periodic inspection and tests shall be made of the main and auxiliary machinery, boilers and equipment as prescribed in this part. The inspections and tests shall be such as to insure that the main and auxiliary machinery, boilers and their appurtenances, and equipment are in satisfactory operating condition and fit for the service for which they are intended.

**§ 61.10–5 Requirements for steam-propelled motorboats.**

(a) The requirements covering design of the propelling engine, boiler, and the auxiliary machinery, and the inspection thereof on all motorboats which are more than 40 feet in length and which are propelled by machinery driven by steam shall be in accordance with the applicable provisions of this subchapter.

(b) If the engines, boilers, and auxiliary machinery are found to be in safe operating condition at the initial or annual inspection, the Officer in Charge, Marine Inspection, shall issue a letter to that effect, and such letter shall be posted on the vessel under glass.

## Subpart 61.15—Tests and Inspections of Machinery and Equipment

**§ 61.15–5 Tests and inspections of steering gear.**

(a) Steering gear shall be tested and inspected by the inspector at the regular annual or biennial inspection and oftener if necessary.

(b) All devices employed in the change-over from automatic to manual operation shall be examined and tested.

**§ 61.15–10 Trial-trip observance.**

The operation of main and auxiliary engines, boilers, steering gear and auxiliaries shall be observed on the trial trip of each new vessel and all deficiencies which affect the safety of the vessel shall be corrected to the satisfaction of the Officer in Charge, Marine Inspection.

**§ 61.15–15 Tail shaft survey.**

(a) The requirements in this section apply only to ocean and coastwise vessels.

(b) Every vessel having the tail shaft fitted with a continuous liner or having shafts of material resistive to corrosive attack of sea water, or where pressure lubrication is used, shall have the tail shaft drawn at least once in every three years; in all other cases the shaft shall be drawn at least once in every two years, or whenever deemed necessary by the Officer in Charge, Marine Inspection. However, if the circumstances warrant it, the Coast Guard District Commander may extend this time to the next regular drydocking period, but not to exceed four months: *Provided,* That when it is shown that a vessel has had a long period of layup, the Coast Guard District Commander may grant an extension equal to the time the vessel has been out of commission, but in no case shall the extension exceed one year.

(c) Where the propelling machinery is located amidships the after bearing shall be rebushed when it is worn down to ¼ inch clearance for shafts of 9 inches or less in diameter, 5/16 inch clearance for shafts exceeding 9 inches but not exceeding 12 inches in diameter and ⅜ inch clearance for shafts exceeding 12 inches diameter. Where the propelling machinery is located aft the maximum clearance shall be one grade (1/16 inch) less than the above clearance.

**§ 61.15–16 Drydock examination.**

When any vessel is drydocked, examination shall be made of the propeller, stern bushing, sea connections, and fastenings if deemed necessary by the inspector.

## Subpart 61.20—Tests and Inspection of Boilers

**§ 61.20–1 Boilers under construction.**

(a) When one or more boilers are under construction, manufacturers shall allow inspectors access to such boilers at such times as the inspectors shall deem necessary in order to determine by actual measurements that the boilers are being constructed in all respects in accordance with the approved design, and that the workmanship is good.

(b) Where boilers or pressure vessels are constructed in one inspection zone for installation on a vessel in another inspection zone, the Officer in Charge, Marine Inspection, in the former inspection zone shall, upon request of the Officer in Charge, Marine Inspection, in the latter inspection zone examine and report on such boilers or pressure vessels and ascertain that the proper materials are being used, and that the workmanship is good.

(c) For inspection of welded pressure vessels under construction, see § 61.25–3.

**§ 61.20–5 Preparation of boilers for inspection and test.**

(a) It shall be the responsibility of the chief engineer to prepare the boilers for inspection. For internal inspection, manhole, and handhole plates, and washout plugs shall be removed as required by the inspector and the furnace and combustion chambers thoroughly cooled and cleaned. Portable obstructions shall be removed as necessary for proper access. In preparing the boilers for the hydrostatic test, they shall be filled with water at not less than 70° F. and not more than 160° F. for water-tube boilers and not more than 100° F. for fire-tube boilers. The safety valves shall be secured by means of gags or clamps.

**§ 61.20–10 New boilers.**

(a) Each new boiler shall be hydrostatically tested after installation to 1½ times the maximum allowable pressure before the boilers are covered. All accessible parts of the boiler shall be examined while under test. After the test, the boiler shall be emptied, opened up and all interior surfaces shall be examined to ascertain that no defects have occurred due to the hydrostatic test.

(b) In addition to the hydrostatic tests prescribed in this section, automatically controlled packaged auxiliary boilers shall be subjected to the performance test specified in Subpart 162.026, Subchapter Q (Specifications) of this chapter.

(c) Upon completion of the hydrostatic test and the boiler examination prescribed in paragraph (a) of this section, and after the installation of the brick work and lagging, those boilers that are to be operated at a pressure equal to or in excess of 400 pounds per square inch gage, or at a steam temperature equal to or in excess of 700° F., may, at the request of the owner or builder, be given an additional test under steam in accordance with the following:

(1) The steam pressure applied to the boilers and to the main and auxiliary steam piping shall not exceed 1¼ times the maximum allowable pressure. Sufficient steam is to be bled from the superheater outlet, either by operating auxiliary machinery, or discharging to the atmosphere, so that service temperatures will not be exceeded. For this test the regular safety valve springs should be replaced by springs designed to operate at the test pressure. After the conclusion of this test the test springs are to be replaced with springs designed to operate at the maximum allowable pressure.

(2) An examination shall be made of all parts of the system during the test to determine there is no evidence of weakness.

**§ 61.20–15 Boilers in service.**

(a) Power boilers, superheaters, economizers, and low-pressure heating boilers shall be examined by an inspector at the regular annual or biennial inspection, and oftener if necessary, to determine that the complete unit is in a safe and satisfactory condition. Where hydrostatic tests are required, an inspection shall be made of all accessible parts while under pressure.

(b) Hydrostatic tests shall be applied to all boilers as provided in Table 61.20–15 (b). The owner, master, or person in charge of the vessel shall give an advance notice to the appropriate Officer

in Charge, Marine Inspection, in order that an inspector will be assigned to witness the test and make the required inspection.

TABLE 61.20-15 (b)—HYDROSTATIC TESTS

| Boiler | Passenger vessels | Cargo, tank and miscellaneous vessels |
|---|---|---|
| Fire tube | Annual | Annual. |
| Water tube | do | Quadrennial. |

(c) Fire tube boilers which cannot be entered or which cannot be satisfactorily examined internally, all boilers of lap seam construction and all boilers to which extensive repairs have been made or the strength of which the inspector has any reason to question, shall be subjected to a hydrostatic test of 1½ times the maximum allowable pressure. All other boilers shall be subjected to a hydrostatic test of 1¼ times the maximum allowable pressure.

(d) In applying hydrostatic pressure to boilers, arrangements shall be made to prevent main and auxiliary stop valves from being subjected at the same time to the hydrostatic pressure on one side and steam pressure on the other side.

(e) If the inspector has reason to believe that the boiler has deteriorated any appreciable extent under the bottom where it rests on saddles or foundations, he shall cause the boiler to be lifted to such position that it can be thoroughly examined, provided the examination cannot be made otherwise.

(f) The marine inspector may require any boiler to be drilled or gaged to determine the actual thickness at any time if doubt exists as to its safety. At the first inspection for certification after a Scotch, Western River, or other fire tube or flue boiler has been installed for ten years, and at such other times as the inspector shall deem necessary, such boilers shall be drilled or gaged at or near the waterline and bottom, and at such other places as the inspector considers necessary, for the purpose of gaging the shell to determine the extent of deterioration. Alternatively, a method of nondestructive examination such as the use of ultrasonic or other acceptable means may be used. Prior to the use of nondestructive methods of examination by the above procedure, it shall be demonstrated by the user, in the presence of a marine inspector on specimens similar to those to be examined, that consistent results having an accuracy of plus or minus 4 percent of the measurements secured by micrometers, are obtainable. If the thickness found by actual measurement is less than the original thickness, the maximum allowable pressure shall be recalculated using the thinnest portion of the shell or head material as the minimum thickness to be used in the calculations, and the maximum allowable pressure thus determined shall not exceed the pressure permitted by the application of the boiler design formulas. For the purpose of such recalculations, the design formulas specified in this subchapter in effect at the time the boilers were originally contracted for or built shall be used. The design formulas specified in Subchapter G (Marine Engineering Installations Contracted for Prior to July 1, 1935) of this chapter may be used for boilers made or contracted for prior to July 1, 1935, or alternatively, the design formulas given in this subchapter may be used.

### § 61.20–20 Boiler mountings and attachments.

(a) All valves and boiler mountings and attachments shall be opened up and examined by the marine inspector after each four years of service.

(b) All boiler mounting studs or bolts shall be examined after each 8 years of service.

(c) (1) Boiler mountings shall be removed from the boiler for examination after each eight years of service where any of the following conditions exist:

(i) Boilers having boiler mountings attached directly to the boiler plating by screwed studs and nuts.

(ii) Boilers having boiler mountings attached to a reinforcing pad by screwed studs and nuts; and this pad is attached directly to the boiler plating.

(iii) Boilers having boiler mountings so installed that a satisfactory examination of these mountings or of their attaching studs cannot be made by removing the bonnet and internal parts of the valve.

(2) Where boiler mountings or valves are attached to boiler nozzles and a satisfactory internal examination of these mountings or valves and their attaching studs, bolts, or other means of attachment, can be performed by opening up the valves, such mountings or valves need not be removed from the boiler unless in the opinion of the Officer in Charge, Marine Inspection, such action is necessary.

(d) The Officer in Charge, Marine Inspection, may require the examinations prescribed in this section to be made at more frequent intervals, if in his opinion such action is necessary to be assured of the safety of the boiler and its attachments.

(e) Water columns, gage glasses, and gage cocks shall be examined to determine that they are in satisfactory working order.

(f) Steam gages on boilers or main steam lines shall be examined and checked for accuracy.

(g) The marine inspector shall examine the fusible plugs.

### § 61.20–25 Boilers of foreign-built vessels admitted to American registry.

(a) Where foreign-built vessels are admitted to American registry the Officer in Charge, Marine Inspection, shall endeavor to secure drawings from which the boilers were constructed and a record of the chemical and physical properties of the material entering into the construction of the boilers. Before a certificate of inspection of a vessel is issued by any Officer in Charge, Marine Inspection, the requirements of this section shall be met.

(b) The drawings if available shall be examined to determine the maximum allowable pressure in accordance with the regulations in this subchapter, and the test reports of the material shall be carefully checked to determine whether the material used in the construction of the boilers is safe.

(c) The boiler or boilers shall be measured in order to obtain accurate data, which data shall be embodied in the report of the inspector making the examination. All plates shall be drilled and gaged by the inspector to determine the actual thickness, and upon the thickness thus obtained the maximum allowable pressure shall be based. The furnaces shall be trammed to ascertain if there is any distortion. The safety valves on the boiler and its superheater shall be Coast Guard approved safety valves designed, constructed and flow-tested in conformance with Subpart 162.001 of Subchapter Q (Specifications) of this chapter. The safety valves and mountings shall be thoroughly examined to determine if they are in good working condition and if their capacity is ample.

(d) Each section of the steam pipe shall be drilled and gaged, and, where bends occur in the piping, they shall be drilled in the outer wall of the bends to determine the thickness thereof.

(e) When the inspection is completed and steam is raised on the boilers, an accumulation test shall be conducted, where required, in accordance with the provisions of § 52.65–5 of this subchapter to establish the fact that the safety valves have ample relieving capacity.

(f) Where drawings of the boilers and test reports of the material entering into their construction cannot be obtained, the maximum allowable pressure shall be based on the actual thickness of material found and an assumed tensile strength not to exceed 60,000 p. s. i., together with the general condition of the boilers: *Provided*, That the maximum allowable pressure thus obtained shall not exceed in any case the maximum pressure allowed by the certificate issued by the government under whose flag the vessel formerly operated.

## Subpart 61.25—Tests and Inspections of Pressure Vessels

### § 61.25–1 Scope.

For exemption of certain pressure vessels from shop inspection, see § 54.01–1 of this subchapter.

### § 61.25–3 Welded pressure vessels under construction.

(a) The manufacturer shall submit class I welded pressure vessels for shop inspection at such stages of partial completion as may be requested by the inspector.

(b) The first inspection of class II welded pressure vessels shall be performed during the welding of the longitudinal joint. At this time the inspector shall check the material and fit-up of the work, and ascertain that only welders who have passed the required tests are employed.

(c) A second inspection of class II welded pressure vessels shall be made during the welding of the circumferential

joints. At this time the inspector shall check any new material being used which may not have been examined at the time of the first inspection, also the fit-up of the vessel at this stage of fabrication, and in addition, observe the welding to ascertain that only welders who have passed the required tests are employed.

(d) For class III welded pressure vessels, one inspection shall be made during the welding of the longitudinal joint. If there is no longitudinal joint, the inspection shall be made during the welding of a circumferential joint. At this time the inspector shall check the material and fit-up of the work and see that only welders who have passed the required tests are employed.

**§ 61.25–5 New pressure vessels.**

(a) Except as otherwise provided for in this section, upon completion of a new pressure vessel one of the following applicable hydrostatic tests shall be made in the presence of an inspector:

(1) Riveted construction: 1½ times the maximum allowable pressure. (See § 61.25–10.)

(2) Welded and brazed construction: 1½ times the maximum allowable pressure. (See § 61.25–15.)

(3) Cast construction: 2 times the maximum allowable pressure.

(b) Pressure vessels containing refrigerants shall be leak-tested with gas after installation to the design pressures specified in § 55.13–5 of this subchapter.

(c) Hydraulic accumulators used in engine starting systems shall be leak-tested to the design pressure after installation.

(d) Pressure vessels designed and/or supported so that they cannot be safely filled with water, or which cannot be dried and are to be used in a service where traces of the testing medium cannot be tolerated, shall be pneumatically tested in accordance with § 61.25–16.

**§ 61.25–10 Hydrostatic test of riveted pressure vessels.**

(a) Riveted pressure vessels shall be hydrostatically tested to not less than 1½ times the maximum allowable pressure for a sufficient time to permit an inspection of all joints and connections.

(b) The tightness of the rivets and the riveted joints shall be tested by tapping the heads with a rivet-testing hammer.

(c) Loose, cracked, and burned rivets shall be replaced.

(d) The inspector shall examine the butt straps and ends of shell plates forming the longitudinal joints to ascertain that they are formed to the proper curvature and that the butt straps are properly fitted at the girth joint intersections.

**§ 61.25–15 Hydrostatic test of welded and brazed pressure vessels.**

(a) All welded or brazed pressure vessels shall satisfactorily pass the hydrostatic test prescribed by this section, excepting those unfired pressure vessels noted under § 61.25–16.

(b) The hydrostatic test pressure shall be at least equal to 1½ times the maximum allowable pressure stamped on the pressure vessel, multiplied by the ratio of the stress value *"S"* at the test temperature to the stress value *"S"* at the design temperature for the materials of which the pressure vessel is constructed. The values for *"S"* shall be taken from Table 52.05–10(a) in § 52.05–10 for ferrous materials and Table 54.03–10(c) in § 54.03–10 for nonferrous materials. The value of *"S"* at test temperature shall be that taken for the material at the tabulated value of temperature closest to the test temperature. The value of *"S"* at design temperature shall be as interpolated from the appropriate table. No ratio less than one shall be used. The design shall consider the combined stress during hydrostatic testing due to pressure and the support reactions. This stress shall not exceed 90 percent of the yield stress of the material at the test temperature. In addition, the adequacy of the supporting structure, during hydrostatic testing, shall be considered in the design.

(c) The hydrostatic test pressure shall be applied for a sufficient period of time to permit a thorough examination of all joints and connections. The test shall not be conducted until the vessel and liquid are at approximately the same temperature.

(d) Pinholes, cracks, or other defects detected during the hydrostatic test or upon examination shall be repaired as required by Part 58 of this chapter.

(e) Vessels requiring stress relieving shall be stress-relieved after any welding repairs have been made.

(f) After repairs have been made the vessel shall again be tested in the regular way, and if it passes the test, the inspector shall accept it. If it does not pass the test, the inspector can order supplementary repairs, or, if in his judgment the vessel is not suitable for service, he may permanently reject it.

**§ 61.25–16 Pneumatic testing of pressure vessels.**

(a) Pneumatic testing of welded pressure vessels shall be permitted only for those units which are so designed and/or supported that they cannot be safely filled with water, or which cannot be dried and are to be used in a service where traces of the testing medium cannot be tolerated.

(b) Proposals to pneumatically test shall be submitted to the Commandant for approval.

(c) Pneumatic testing shall be limited to unfired pressure vessels designed and constructed to the requirements of Class I pressure vessels.

(d) The pneumatic test shall be 1.25 (1¼) times the maximum allowable pressure of the vessel.

(e) The pneumatic test of pressure vessels shall be accomplished as follows:

(1) The pressure on the vessel shall be gradually increased to not more than half the test pressure.

(2) The pressure will then be increased at steps of approximately one-tenth the test pressure, until the test pressure has been reached.

(3) The pressure will then be reduced to maximum allowable pressure of the vessel to permit examination.

(f) Pressure vessels pneumatically tested shall also be leak-tested. The test shall be capable of detecting leakage consistent with the design requirements of the pressure vessel. Details of the leak test shall be submitted to the Commandant for approval.

(g) After satisfactory completion of the pneumatic pressure test, the vessel may be stamped in accordance with § 61.40–5. A marine inspector shall observe the pressure vessel in a loaded condition at the first opportunity following the pneumatic test. The tank supports and saddles, connecting piping, and insulation if provided shall be examined to determine they are satisfactory and that no leaks are evident.

(h) The pneumatic test is inherently more hazardous than a hydrostatic test, and suitable precautions shall be taken to protect personnel and adjacent property.

**§ 61.25–20 Pressure vessels in service.**

(a) At each initial and subsequent inspection for certification the marine inspector shall examine or test all unfired pressure vessels to the extent necessary to determine that their condition is satisfactory and that they are fit for service intended.

(b) Unfired pressure vessels which are fitted with manholes or other inspection openings, so they can be satisfactorily examined internally, except as otherwise exempted by provisions of this section, shall be opened biennially at the regular annual or biennial inspection and thoroughly examined internally and externally. Such pressure vessels are not required to be hydrostatically tested unless defects are found which in the marine inspector's opinion may impair the safety of the pressure vessel. In this case a hydrostatic test shall be applied at a pressure equal to 1¼ times the maximum allowable pressure.

(c) Tubular heat exchangers, hydraulic accumulators, and those pressure vessels used in refrigeration service shall be examined under operating conditions at the regular annual or biennial inspection.

(d) All unfired pressure vessels, other than those exempt by the provisions of this section, shall be subjected to a hydrostatic test 1¼ times the maximum allowable pressure biennially at the regular annual or biennial inspection.

(e) The following unfired pressure vessels will not normally be subjected to a hydrostatic test:

(1) Tubular heat exchangers.

(2) Pressure vessels used in refrigeration service.

(3) Hydraulic accumulators.

(4) Unfired pressure vessels which have been satisfactorily examined internally by a marine inspector and in which no defects have been found which impair the safety of the pressure vessel.

(5) Unfired pressure vessels which have an internal volume of not more than 5 cubic feet and a maximum allow-

able pressure of not more than 100 pounds per square inch.

(6) Compression tanks containing water under pressure, including those containing an aircushion, subject to pressures not exceeding 100 pounds per square inch and temperatures not exceeding 200 degrees F., except those fitted with permanent air charging lines.

(7) All unfired pressure vessels having a maximum allowable working pressure not exceeding 15 pounds per square inch.

(8) Pressure vessels containing mediums at or below pressures and temperatures specified in Table 61.25–20(e).

TABLE 61.25–20(e)

| Service | Pressure p.s.i. | Temperature ° F. |
|---|---|---|
| Steam, gas, or vapors | 15 | |
| Fuel oil | 100 | 150 |
| Lubricating oil | 100 | 200 |
| Liquids, except fuel oil, and lubricating oil | 100 | 300 |

(9) Pressure vessels which have been pneumatically tested in accordance with § 61.25–16.

(f) Unfired pressure vessels containing liquefied compressed gases or hazardous liquids shall be inspected and tested as required by the applicable regulations published in Subchapter D (Tank Vessels) and Subchapter N (Dangerous Cargoes) of this chapter.

(g) Bulk storage tanks containing refrigerated liquefied $CO_2$ gas for use on board vessels as a fire extinguishing agent shall be subjected to a hydrostatic test at the periodic inspection period on the eighth year of the installation and at eight-year intervals thereafter. The hydrostatic test pressure shall be 1½ times the allowable pressure. At the conclusion of the hydrostatic test, the tank shall be drained and an internal examination made. Portions of the jacket and lagging on the underside of the tank shall be removed at the time of the hydrostatic test as deemed necessary by the marine inspector so as to determine the external condition of the tank.

(h)(1) Pressure vessels which have been pneumatically tested shall be thoroughly examined internally and externally biennially at the regular annual or biennial inspection, except in those instances where the inspection interval is prescribed otherwise by the specific regulations applicable to the product carried in Subchapter D (Tank Vessels), Subchapter I (Cargo and Miscellaneous Vessels), or Subchapter N (Dangerous Cargoes) of this chapter. For those tanks the design of which precludes a thorough internal or external examination, the thickness shall be determined by nondestructive method acceptable to the Officer in Charge, Marine Inspection.

(2) Such pressure vessels in service are not required to be pneumatically tested unless repairs have been made to them, or unless defects are found which in the opinion of the marine inspector, may impair the safety of the pressure vessel. If required, the pneumatic test shall be conducted in accordance with § 61.25–16.

## Subpart 61.30—Tests and Inspection of Piping, Valves, and Fittings

### § 61.30–1 Scope.

In conducting hydrostatic tests on piping, the required test pressure shall be maintained for a sufficient length of time to permit an inspection to be made of all joints and connections, and the setting of the relief valve or safety valve will be considered as establishing the maximum allowable pressure of the system.

### § 61.30–5 Shop test.

(a) The manufacturer shall test all valves and pipefittings, except pipe flanges, wrought steel welding fittings and welding necks, to a hydrostatic shell pressure as follows:

(1) For steam ratings:

(i) Bronze, malleable iron and cast iron—2 times the primary pressure rating marked on the valve or fitting.

(ii) Steel—The respective test pressure as prescribed in the American Standard for Steel Pipe Flanges and Flanged Fittings (ASA B16.5).

(2) For liquid or gas service not exceeding 150 degrees F.:

(i) Bronze or malleable iron—1½ times the secondary pressure rating marked on the valve or fitting.

(b) Special valves, such as manifolds, scuppers, seacocks and appurtenances, shall be tested to twice the design pressure stamped thereon.

(c) Special welded pipe fittings fabricated with a longitudinal joint which are not manufactured in conformance with the A. S. T. M. Standard specified in Subpart 51.46 of this subchapter shall be tested as required by § 56.01–85 of this subchapter.

(d) Hydraulic piping assemblies and associated hydraulic equipment components, including hydraulic steering gear, in lieu of being tested at the time of installation, may be shop tested by the manufacturer to 1½ the maximum allowable pressure of the system. The required test pressure shall be maintained for a sufficient amount of time to check all components for strength and porosity and to permit an inspection to be made of all connections.

### § 61.30–10 Installation test.

(a) The following piping systems shall be hydrostatically tested in the presence of a marine inspector at a pressure of 1½ times the maximum allowable pressure:

(1) Class I steam, feed-water and blowoff piping. Where piping is attached to boilers by welding without practical means of blanking off for testing, the piping shall be subjected to the same hydrostatic pressure to which the boilers are tested. The maximum allowable pressures of boiler feed-water and blowoff piping shall be the design pressures specified in §§ 55.10–10(a)(3) and 55.10–15(b) in Part 55 of this subchapter.

(2) Fuel oil discharge piping between the pumps and the burners, but not less than 500 pounds per square inch.

(3) High-pressure piping for tank-cleaning operations.

(4) Flammable or corrosive liquids and compressed gas cargo piping, but not less than 150 pounds per square inch.

(5) Any Class I piping not specifically listed in this paragraph.

(6) Cargo oil piping.

(7) Firemains, but not less than 150 pounds per square inch.

(8) Fuel oil transfer and filling piping.

(9) Class I compressed air piping.

(b) Refrigeration piping shall be leak-tested to the design pressures as specified in § 55.13–5 of this subchapter.

(c) Hydraulic piping assemblies and associated hydraulic equipment components which have been tested in conformance with § 61.30–5(d) and so certified by the manufacturer, may be tested after installation as a complete assembly by stalling the driven unit in a safe and satisfactory manner and by blowing the relief valves. Otherwise, these systems shall be hydrostatically tested in the presence of an inspector at a pressure of 1½ times the maximum allowable pressure.

(d) Piping systems not specifically listed in this section shall be tested under working conditions.

(e) Arc- or gas-welded pipe joints of Class I piping which are not examined by radiography shall be given a hammer test as required by § 61.25–15.

### § 61.30–15 Piping in service.

(a) Main steam piping shall be subjected to a hydrostatic test equal to 1¼ times the maximum allowable pressure at the same periods prescribed for boilers in § 61.20–15. The hydrostatic test shall be applied from the boiler drum to the throttle valve. If the covering of the piping is not removed, the test pressure shall be maintained on the piping for a period of ten minutes, and, if any evidence of moisture or leakage is detected, the covering shall be removed and the piping thoroughly examined.

(b) Steam piping subject to main boiler pressure and exceeding 3 inches in diameter, except as otherwise provided for in paragraph (a) of this section, shall be subjected to a hydrostatic test pressure of 1¼ times the maximum allowable pressure after each 4 years of service. If the covering of the piping is not removed, the test pressure shall be maintained on the piping for a period of ten minutes, and, if any evidence of moisture or leakage is detected, the covering shall be removed and the piping thoroughly examined.

(c) The setting of safety valves or relief valves on reduced pressure lines, evaporators, feed water heaters, and other pressure vessels shall be checked by the inspector at each regular annual or biennial inspection.

### § 61.30–20 Sea chests, sea valves and strainers.

(a) Sea chests, sea valves, sea strainers and bilge injection valves shall be opened up for examination at the time of drydocking if deemed necessary by an inspector.

## Subpart 61.35—Proof Hydrostatic Tests

### § 61.35–1 Hydrostatic tests of boilers and appurtenances to determine pressure rating.

(a) *Scope.* (1) Where it is necessary to test a pressure vessel, or appurtenance, or any pressure part thereof, to determine a pressure rating in accordance with the provisions of § 52.01–70 of this subchapter the procedure specified in this subpart shall be adhered to as closely as practicable.

(2) This method of test is applicable only to materials having a definite proportional or elastic limit such as carbon and alloy steels. It is not applicable to materials with indefinite or indeterminate proportional limits such as cast iron and most nonferrous materials. The principle upon which the test is based assumes that the most highly stressed point in the pressure part will be subjected to a permanent set when the stress at this location reaches the proportional or elastic limit. Since the stress will be directly proportional to the hydrostatic pressure, the determination of the pressure which stresses the weakest point to the proportional limit will permit a calculation of the maximum allowable pressure that will result in a safe stress for the material from which the part is made at the maximum operating temperature.

(b) *Materials.* The structure shall be made from material conforming to the requirements of the appropriate subpart of Part 51 of this subchapter.

(c) *Workmanship.* The dimensions, thickness, and physical properties of the structure to be tested shall not vary materially from those actually used. If possible, the structure to be tested may be selected at random from a quantity of such intended for use.

(d) *Preparation for test.* (1) It is necessary to test only the weakest point of the structure but several points may be checked to make certain that the weakest one is included. The less definite the location of the weakest point, the more points shall be checked.

(2) The movement of the reference points may be measured with reference to a fixed surface, or two reference points may be located on opposite sides of a symmetrical structure and the total deformation between those two points measured.

(3) Indicating micrometer gages accurate to 0.001 inch are most suitable for measuring deformation of the structure at the reference points although any form of accurate micrometer may be used.

(4) A hand-test pump is satisfactory as a source of hydrostatic pressure. Either a test gage or a reliable gage which has been calibrated with a test gage shall be attached to the structure.

(5) The maximum hydrostatic pressure that shall be provided will vary from two or three times the expected maximum allowable pressure for carbon-steel structures.

(6) The location of the weakest point of the structure may be determined by applying a thin coating of plaster of paris or similar material, and noting where the surface coating starts to break off under hydrostatic test. The coating shall be allowed to dry before the test is started.

(e) *Hydrostatic tests.* (1) The first application of hydrostatic pressure shall be approximately the expected maximum allowable pressure, or the tests may be arranged with a view to making not less than 10 applications of pressure in approximately equal increments between the initial test pressure and the final test pressure.

(2) When each increment of pressure has been applied, the valve between the pump and the structure under test shall be closed and the pressure gage watched to see that the pressure is maintained and no leakage occurs. The total deformation at the reference points shall be measured and recorded and the hydrostatic pressure also recorded. The pressure shall then be released and each point checked for any permanent deformation which may be recorded. Only one application of each increment of pressure is necessary. The pressure shall be increased by substantially uniform increments, and readings taken until the elastic limit of the structure has obviously been exceeded.

(3) The pressure part shall not have been subjected to a pressure greater than twice the maximum allowable pressure prior to making the proof hydrostatic test.

### § 61.35–5 Proportional limit method.

(a) *Physical characteristics of metal.* (1) The proportional limit of the material should be determined in accordance with A. S. T. M. Specification E8, Methods of Tension Testing of Metallic Materials. This test shall be made from a number of specimens cut from the part tested, in order to assure that the average proportional limit of the material in the part tested is used to calculate the allowable pressure.

(2) The specimens shall be cut from a location where the stress during the test has not exceeded the proportional limit, so that the specimens will be representative of the material as tested. The specimens shall not be cut with a flame torch.

(b) *Plotting curves.* In plotting curves, a single cross-section sheet may be used for each reference point of the structure. A scale of 1 inch=0.01 inch deformation, and a scale of at least 1 inch equals the approximate test pressure increments have been found satisfactory. Plot two curves for each reference point, one showing total deformation under pressure and one showing permanent deformation when the pressure is removed.

(c) *Determining proportional limit of pressure part.* In determining the proportional limit of pressure parts, the following procedure shall be employed:

(1) Locate the proportional limit on each curve of total deformation as the point at which the total deformation ceases to be proportional directly to the hydrostatic pressure. Draw a straight line that will pass through the average of the points that lie approximately in a straight line. The proportional limit will occur at the value of hydrostatic pressure where the average curve through the points deviates from the straight line.

(2) In pressure parts such as headers, where a series of similar weak points occur, the average hydrostatic pressure corresponding to the proportional limits of the similar points may be used.

(3) The proportional limit obtained from the curve of total deformation may be checked from the curve of permanent deformation by locating the point where the permanent deformation begins to increase regularly with further increases in pressure. Permanent deformations of a low order that occur prior to the point actually corresponding to the proportional limit of the structure, resulting from the equalization of stresses and irregularities in the material, may be disregarded.

(4) It should be made certain that the curves show the deformation of the structure and not slip or displacement of reference surfaces, gauges, or the structure.

(d) *Determining maximum allowable pressure.* (1) Having determined the hydrostatic pressure when the proportional limit of the weakest point of the vessel was reached, the corresponding maximum allowable pressure may be determined by formula (1):

$$P=\frac{HS}{E} \qquad (1)$$

where:

$P$ = maximum allowable pressure, in p. s. i.
$H$ = hydrostatic pressure at the proportional limit of the pressure part, in p. s. i.
$S$ = Maximum allowable stress, 80 percent of the values, as given in Table 52.05–10(a).
$E$ = average proportional limit of the material, in p. s. i.

(2) For carbon steel material, complying with the material specifications in Part 51 of this subchapter and with a minimum tensile strength not over 62,000 p. s. i., the proportional limit may be assumed to be two-fifths of the average tensile strength of the specified range. Where no range is specified, the average tensile strength may be assumed as 5,000 p. s. i. greater than the minimum. This alternate procedure will eliminate the necessity for cutting tensile specimens and determining the actual proportional limit above the normal value. The pressure part shall be normalized after forging or forming.

(e) *Retests.* A retest will be allowed on an additional similar vessel if errors or irregularties are obvious in the results.

## Subpart 61.40—Markings

### § 61.40–1 Boilers.

(a) Upon satisfactory completion of the tests and inspection of a new boiler the following data shall be stamped on

the front head of fire-tube boilers and on the drum head of water-tube boilers:

---
(Name of fabricator and serial number)

---p.s.i.
(Maximum allowable pressure)

---p.s.i.
(Hydro test pressure)

---p.s.i.
(Steam test pressure)

---
(U.S.C.G. No.)

---
(C.G. Symbol)

---
(Inspector's initials)

---
(Month and year fabricated)

(b) The inscription on the boiler and the boiler nameplate, as required in paragraph (a) of this section, shall contain the following entry for steam tests: "Steam test ------ p. s. i.," which shall follow the notation for hydrostatic test.

(c) The data shall be legibly stamped and shall not be obliterated during the life of the boiler. In the event that the portion of the boiler upon which the data is stamped is to be insulated or otherwise covered, the data shall be transferred to a metal nameplate which shall be attached to the boiler casing or the uptake. The nameplate shall be maintained in a legible condition so that the data can be easily read.

**§ 61.40–5 Unfired pressure vessels.**

(a) After a marine inspector has examined a new pressure vessel subject to inspection and has determined that the vessel has been constructed in accordance with the applicable parts of this subchapter, and the vessel has satisfactorily withstood the required tests, the following data shall be stamped thereon:

---
(Name and address of fabricator)

---p.s.i.
(Maximum allowable pressure)

---p.s.i.
(Hydro test pressure)

---
(O.C.M.I. No., inspector's initials, and C.G. symbol)

---
(Mfr. serial No.)

---
(Month and year)

---
(Riveted, brz., welded (class))

(b) Those pressure vessels which must be pneumatically tested shall be stamped with "Pneumatic test pressure ------ p.s.i.".

### Subpart 61.45—Official Forms

**§ 61.45–1 Scope.**

This subpart includes descriptions of the official forms required to be submitted to the Coast Guard by the regulations in this subchapter. Copies of the forms may be obtained upon request from the nearest Officer in Charge, Marine Inspection, or the Commandant (MMT), United States Coast Guard, Washington, D.C., 20226.

**§ 61.45–5 Form CG–2935; boiler data report; manufacturer's certification.**

The manufacturer of each boiler to be used on vessels subject to inspection by the Coast Guard shall submit to the Officer in Charge, Marine Inspection, at or nearest the place where the manufacturer's plant is located, a data report in triplicate on form CG–2935 together with a certification that the data is correct and that the material and fabrication of this boiler comply with all the regulations applicable thereto.

**§ 61.45–10 Form CG–2936; unfired pressure vessel data report; manufacturer's certification.**

The manufacturer of unfired pressure vessels to be used on vessels subject to inspection by the Coast Guard shall submit to the Officer in Charge, Marine Inspection, at or nearest the place where the manufacturer's plant is located, a data report in triplicate on form CG–2936 together with a certification that the data is correct and that the material and fabrication comply with all the regulations applicable thereto.

**§ 61.45–15 Form CG–935A; affidavit of manufacturer of class B material or appliances.**

The manufacturer of either class B materials or appliances for use on vessels subject to inspection by the Coast Guard and to the regulations in this subchapter shall submit to the Commandant (MMT), United States Coast Guard, Washington, D.C., 20226, an affidavit on form CG–935A certifying that certain product(s) of his manufacture furnished directly or through agents or dealers for use on vessels subject to inspection by the Coast Guard will comply with all regulations applicable thereto.

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## SUBCHAPTER G—MARINE ENGINEERING INSTALLATIONS CONTRACTED FOR PRIOR TO JULY 1, 1935

## PART 66—GENERAL

### Subpart 66.01—General Provisions

Sec.
66.01–1 Authority.
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### Subpart 66.30—Welded Steel and Iron Pipe

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66.35–10 Flattening test.
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66.35–20 Marking.
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AUTHORITY: The provisions of this Part 66 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426–4431, as amended, 4433, as amended, 4434, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404–409, 411, 412, 435, 481, 489, 366, 395, 363, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857.

### Subpart 66.01—General Provisions

**§ 66.01–1 Authority.**

(a) The authority to prescribe regulations generally is set forth in R.S. 4405 and 4462, as amended (46 U.S.C. 375 and 416), as well as in other provisions of Title 52 of the Revised Statutes and acts amendatory thereof or supplemental thereto. Under the provisions of R.S. 4403, as amended (46 U.S.C. 372), the

Commandant, United States Coast Guard, superintends the administration of the vessel inspection laws and is required to produce a correct and uniform administration of the inspection laws, rules, and regulations.

**§ 66.01–5 Assignment of functions.**

By Reorganization Plan No. 3 of 1946, effective July 16, 1946, the marine inspection functions of the former Bureau of Marine Inspection and Navigation and its officers and employees were transferred to the Commandant, United States Coast Guard. By Reorganization Plan No. 26 of 1950, effective July 31, 1950, 3 CFR, 1950 Supp., p. 178, the functions formerly vested in the Commandant, United States Coast Guard were transferred to the Secretary of the Treasury with certain specific exceptions. The Secretary of the Treasury by an order dated July 31, 1950 (15 F. R. 6521), delegated to the Commandant the functions formerly performed by him under Reorganization Plan No. 3 of 1946.

**§ 66.01–10 Purpose of regulations.**

The purpose of the regulations in this subchapter is to set forth uniform minimum requirements for marine engineering in accordance with the intent of Title 52 of the Revised Statutes and acts amendatory thereof or supplemental thereto, as well as to implement various International Conventions for Safety of Life at Sea and other treaties which affect the merchant marine. The regulations are necessary to carry out the provisions of law affecting inspected vessels and such regulations have the force of law.

**§ 66.01–15 Application of regulations.**

(a) The regulations in this subchapter, apply only to installations contracted for or built prior to July 1, 1935, and contain specifications and requirements for materials, design, construction, installation and inspection of boilers, unfired pressure vessels, safety valves and appurtenances, including piping system, upon the strength and efficiency of which safety of life is dependent.

(b) The regulations in Subchapter F (Marine Engineering) of this chapter, apply to installations contracted for or built on or after July 1, 1935.

(c) Where existing vessels are reboilered, the mountings and attachments, including feed and blowoff valves and fittings, shall be renewed in accordance with the regulations in Subchapter F (Marine Engineering) of this chapter in effect at the time such work is contracted for or built. The steam piping shall be gaged and examined by the Officer in Charge, Marine Inspection, and if found to be of the thickness required at the time the piping was installed it may be continued in use so long as the Officer in Charge, Marine Inspection, is of the opinion that the piping may be safely continued in use. Changes in specifications of articles of equipment shall not apply to such articles which have been passed as satisfactory until replacement shall become necessary.

## Subpart 66.03—Definition of Terms Used in This Subchapter

**§ 66.03–1 Commandant.**

The term "Commandant" means the Commandant of the Coast Guard.

**§ 66.03–5 Coast Guard District Commander.**

The term "Coast Guard District Commander" means an officer of the Coast Guard designated as such by the Commandant to command all Coast Guard activities within his district, which include the inspections, enforcement, and administration of Title 52, Revised Statutes, and acts amendatory thereof or supplemental thereto, and rules and regulations thereunder.

**§ 66.03–10 Officer in Charge, Marine Inspection.**

The term "Officer in Charge Marine Inspection," means any person from the civilian or military branch of the Coast Guard designated as such by the Commandant and who under the superintendence and direction of the Coast Guard District Commander is in charge of an inspection district for the performance of duties with respect to the inspection, enforcement, and administration of Title 52, Revised Statutes, and acts amendatory thereof or supplemental thereto, and rules and regulations thereunder.

**§ 66.03–15 Marine inspector or inspector.**

The terms "marine inspector" or "inspector" mean any person from the civilian or military branch of the Coast Guard assigned under the superintendence and direction of an Officer in Charge, Marine Inspection, or any other person as may be designated for the performance of duties with respect to the inspections, enforcements, and the administration of Title 52, Revised Statutes, and acts amendatory thereto, and rules and regulations thereunder.

**§ 66.03–20 Requirements.**

The term "requirements" refers to process of manufacture, characteristic, physical and chemical properties, tests, workmanship, and finish of materials.

**§ 66.03–25 Headquarters.**

The term "headquarters" means the Office of the Commandant, United States Coast Guard, Washington, D.C., 20226.

## Subpart 66.05—General Material Requirements

**§ 66.05–1 Repair or replacement parts.**

(a) Plates and steel bars subject to tensile stress used in the repair or replacement of pressure parts of boilers shall be tested, inspected, and stamped by an inspector in accordance with the requirements of Title 52 of the Revised Statutes of the United States, for Class A material, and shall conform to the applicable requirements of Part 51 of Subchapter F (Marine Engineering) of this chapter.

(b) Material used for pressure parts in the repair of pressure vessels other than boilers and in the repair or replacement of boiler tubes, piping, valves and fittings may be of Class B certified material conforming to the applicable requirements of Part 51 of Subchapter F (Marine Engineering) of this chapter.

**§ 66.05–5 General classification of materials.**

(a) *General.* The materials to be used in the construction and for the repair of boilers and unfired pressure vessels, piping, valves, fittings, and appurtenances shall be of three general classes of which Classes A and B shall be used for pressure parts and Class C may be used for other parts as specified.

(b) *Class A.* Tested materials manufactured under the supervision of the Coast Guard, test of which shall be witnessed by an inspector.

(c) *Class B.* Certified materials tested by the manufacturers, and certified by them as conforming to the requirements.

(d) *Class C.* Materials for nonpressure parts of boilers or unfired pressure vessels such as casing for water-tube boilers, uptakes, furnace fronts, and operating equipment shall be of good commercial quality. No detail requirements are herein specified for material in this class. Class C materials shall be accepted by inspectors without requiring tests or certification by manufacturers.

**§ 66.05–10 Basic information requirements.**

(a) When ordering Class A material for the repair of boilers or unfired pressure vessels installed on vessels subject to the inspection of the Coast Guard, the manufacturer of the material shall, as far as practicable, furnish the following information to the Officer in Charge, Marine Inspection, at or nearest the place where the boiler or unfired pressure vessel is to be repaired.

(1) Name and location of manufacturer's works.

(2) Type of boiler or unfired pressure vessel.

(3) Manufacturer's slab or plate number.

(4) Design pressure and temperature.

(5) Vessel's name.

**§ 66.05–15 Inspection and testing of class A material.**

Inspectors shall have free entry at all times to those parts of the works where material subject to the regulations in this part is being manufactured. The manufacturer shall afford inspectors all reasonable facilities to satisfy them that the material is being manufactured in accordance with the requirements of the Commandant. Unless otherwise authorized, tests and inspection shall be made at the place of manufacture prior to shipment and shall be so conducted as not to interfere unnecessarily with the operation of the works. Inspectors shall assure themselves that test specimens are marked for positive identification with the materials which they represent. Unless otherwise specified, tests shall be made at ordinary temperature.

**§ 66.05–20 Chemical analyses.**

(a) A ladle analysis of each melt of Class A or B materials as specified by Part 51 of Subchapter F (Marine Engineering) of this chapter, shall be made by the manufacturer and a certified report thereof shall be furnished by him to the inspector upon request. This analysis shall be made from a test ingot taken during the pouring of the melt. The chemical composition thus determined shall conform to the specified requirements.

(b) A check analysis may be made at the discretion of the Commandant from test specimens representing material for which chemical composition is specified in any section of this part, in either Class A or B. The chemical composition thus determined shall conform to the requirements.

**§ 66.05–25 Certification of class B material.**

(a) Certification of chemical analyses and physical tests of materials of Class B shall be an affidavit by the manufacturer certifying that all materials of this class supplied by him for marine service do, or will conform to all the requirments in Subchapter F (Marine Engineering) of this chapter applicable thereto.

(b) Materials in this class are not required to be tested in the presence of an inspector, but whenever deemed necessary by the Commandant he may detail an inspector to witness such tests and satisfy himself that the requirements of the specification for Class B materials are met.

**§ 66.05–30 Tension tests.**

All tension tests shall be made on standard calibrated machines. The yield point in tension tests shall be determined by the drop of the beam or the halt in the gage of the testing machine. Except where otherwise specified in Part 51 of Subchapter F (Marine Engineering) of this chapter, the speed of the crosshead of the machine shall not exceed 1/16 inch per minute per inch of gage length up to the yield point, nor shall it exceed ½ inch per minute per inch of gage length beyond the yield point. Any convenient speed of the crosshead may be used from the start of loading the test specimen until a value estimated as one-half of the yield point is reached. In determining the yield strength by use of an extensometer, the crosshead speed shall not exceed 0.025 inch per minute per inch of gage length. In the event the machine is stopped in taking readings, the speed may be exceeded in the take up only. The ends of all test specimens shall be of form to fit the holders of the testing machine in such a way that the load will be axial.

**§ 66.05–35 Test reports.**

Inspectors shall report the results of official tests on form CG–934. Duplicate copies thereof shall be forwarded through the Coast Guard District Commander in the district where the material was manufactured to the Coast Guard District Commander in the district where the material is to be fabricated.

**§ 66.05–40 Retests.**

When the result of any of the physical tests specified for any of the materials does not conform to the requirements, two additional specimens may, at the request of the manufacturer be taken from the same lot and tested in the manner specified, but in such case, both of the specimens shall conform to the requirements. In the case of tension tests, this retest shall be allowed if the percentage of elongation obtained is less than required, or if any part of the fracture is outside of the middle third of the gauge length. If any test specimen develops flaws, it shall be discarded and another specimen from the same lot substituted.

**§ 66.05–45 Rejections.**

Failure of the tests (or retests) specified in the regulations in this subchapter for each particular material shall be cause for rejection. Unless otherwise required, any rejection shall be reported by the inspector within 5 working days from the receipt of the test specimen. Acceptance of material on results of tests at the place of manufacture shall not prejudice the right to reject any of such material in which injurious defects are subsequently discovered. The manufacturer shall be promptly notified of such subsequent rejections, and the records shall be corrected.

**§ 66.05–50 Appeals.**

In case of dissatisfaction with the results of any test, the manufacturer may appeal to the Coast Guard District Commander from the decision of the Officer in Charge, Marine Inspection, within 30 days. Should the Coast Guard District Commander sustain the Officer in Charge, Marine Inspection, the manufacturer may appeal to the Commandant within 30 days. Tested specimens which represent rejected material shall be retained for at least 30 days. The decision of the Commandant shall be final.

**§ 66.05–55 Process of steel manufacture.**

Unless otherwise officially authorized by the Commandant, all wrought steel to be used in the repair of boilers or unfired pressure vessels shall be manufactured by the open-hearth, electric furnace, or crucible process.

**§ 66.05–60 Stamping plates and specimens.**

(a) Class A plates used for repairs to boilers shall be stamped by the manufacturer, before they are tested, with his name or trademark, the word "Marine", the letter indicating the grade of the steel, and the minimum tensile strength of the plate per square inch of cross-sectional area expressed in thousands. Inspectors shall permit cutting a plate into two or more parts before testing, but each part shall be stamped or match-marked for identification before cutting. All plates accepted by the inspector as conforming to the requirements shall be stamped by him near the manufacturer's stamp with the official stamp of the Coast Guard, the initials of his name, and the serial number. All test specimens shall be ring-stamped or match-marked for identification before being detached. Plates shall be stamped lengthwise in two places on one long side about 18 inches from the edges at the corners. Each butt strap shall be stamped lengthwise of the plate about the middle of the strap.

(b) The impression of the official stamp of the Coast Guard for stamping plates and specimens shall be as shown in Figure 66.05–60.

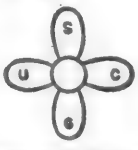


FIGURE 66.05–60—Official stamp.

**§ 66.05–65 Stock plates.**

Plates may be ordered to be carried in stock ashore or on shipboard for repairs to boilers and unfired pressure vessels. Such plates shall be inspected and tested at the place of manufacture and stamped for identification as stock plates. A test report for such plates shall be furnished to the Coast Guard District Commander of the district where the purchaser is located, with a copy to the purchaser. The Coast Guard District Commander shall furnish a copy thereof to the Officer in Charge, Marine Inspection, where the material is kept in stock, and if the material is to be used by persons other than the original purchaser, they shall also be furnished with a copy of such report, for submittal by them to the Officer in Charge, Marine Inspection, where the repairs are actually to be made before the material may be used. Vessels carrying such stock plates shall obtain and carry identification and test records of each plate. Where such plates are cut into pieces for repairs, the Officer in Charge, Marine Inspection, shall, upon request, stamp each piece so detached for identification with the original plate and a record of such stamping shall be made.

**§ 66.05–70 Workmanship and finish.**

All materials within the scope of the regulations in this subchapter shall be free from injurious defects and shall have a workmanlike finish.

**§ 66.05–75 Heat treatment.**

Some of the materials specified in this part require heat treatment. This may consist of annealing, or of normalizing, or of normalizing followed by annealing, or of normalizing followed by a draw back to a temperature below the critical range. Annealing shall consist of allowing material to cool after forging or rolling to a temperature below the critical range, then reheating it to proper temperature to refine the grain and allowing it to cool in the furnace. Normalizing shall consist of allowing material to cool after forging or rolling to a temperature below the critical range, then reheating it to proper temperature to refine the grain and allowing it to cool in still air.

**§ 66.05–80 Reclassification of materials.**

When more than one grade is specified for any material or purpose and tests of a material of a superior grade fail to meet the requirements, such material may be reclassified and accepted as a specified lower grade if it fulfills the specified requirements for the latter. In such cases, the material shall be restamped or remarked as required for proper identification, and revised records shall be made to cover it.

**§ 66.05–85 Alternative materials.**

If, in the development of industrial arts, other suitable or improved materials differing from those specified in this part are developed, their use will be given consideration, upon formal application to the Commandant with full information as to the characteristics of the material, and such scientific data and facts as may be necessary to establish the suitability and safety of the material for the use proposed. The material requirements in this subchapter are minimum requirements and are not intended to bar better materials.

## Subpart 66.10—Boiler Plate

**§ 66.10–1 Inspection and marking.**

(a) Every iron or steel plate intended for the construction of boilers to be used on steam vessels shall be stamped by the manufacturer in the following manner, at two diagonal corners, at a distance of about 18 inches from the edges.

(b) Plates to be used in the construction of externally fired boilers, the thickness of which shall not exceed one-half inch for steamers navigated under the provisions of Title 52, Revised Statutes, sections 4399–4500, which will be subject to tensile strain in said boilers, shall be Class A material tested and inspected by an inspector, and such plates shall not be stamped until they have been tested by the inspector, and each of such plates shall then be stamped by the manufacturer in the presence of the inspector with the name of the manufacturer, the place where manufactured, and the minimum number of thousand pounds tensile stress it will bear to the sectional square inch as has been determined by the test.

(c) Plates to be used in the construction of boilers other than the externally fired boilers as described in paragraphs (a) and (b) of this section, for steamers navigated under provisions of Title 52, Revised Statutes, sections 4399–4500, as amended (46 U. S. C. 361–498), which shall be subject to tensile strain in said boilers shall be a material tested and inspected by an inspector and such plates shall be stamped by the manufacturer before same are tested with the name of the manufacturer, the place where manufactured, and the minimum number of pounds the plate will bear to the sectional square inch, expressed in thousands.

(d) Inspectors testing iron or steel plate at the mills where same is manufactured shall allow the mills to shear any plate into butt straps or heads before the coupon from the plate is tested, and they shall accept the statement of the manufacturer that the coupon presented to the inspector for testing was taken from the plate from which the butt straps or heads were cut, and if the coupon meets all the requirements of this subpart the inspector shall stamp, in one place where it is most likely to be left legible after working into the boiler, all heads and butt straps cut from the plate.

(e) All plates which conform to the physical, chemical, and other requirements prescribed in this subchapter shall be stamped by the inspector near the manufacturer's stamp with the official stamp of the Coast Guard, and with the initials of his name and a serial number.

**§ 66.10–5 Chemical properties, steel plates.**

(a) Steel plates shall be made by open-hearth process, except that steel for plates to be used in the manufacture of boiler tubes may be made by the Bessemer process.

(b) Open-hearth steel shall contain not more than 0.04 percent of phosphorus nor more than 0.05 percent of sulphur.

(c) The manufacturer shall furnish the inspector with each order tested, a certificate stating the process by which the steel was manufactured and a copy of the analysis of each melt. The analysis may, if deemed expedient by the Commandant, be verified at the expense of the manufacturer.

**§ 66.10–10 Physical properties, steel plates.**

(a) All steel plates tested shall show an elongation of at least 20 percent measured in a gage length of 8 inches.

**§ 66.10–15 Physical properties, iron plates.**

(a) The tensile strength shall be not less than 45,000 pounds per square inch. The elongation shall be not less than 15 percent. The reduction of area shall be not less than 15 percent for 45,000 p. s. i. tensile strength, and for each increase of 1,000 p. s. i. tensile strength up to 55,000 p. s. i., an addition of 1 shall be made to the required percentage of reduction of area. The bend test specimen shall bend cold through 90 degrees around a curve the radius of which is not greater than one and one-half times the thickness of the specimen.

**§ 66.10–20 Tension and bend tests.**

(a) All tension test specimens shall be milled to the form as shown in Figure 66.10–20 (a), with the following dimensions: Length at least 16 inches, ends from 1½ to 3½ inches wide by about 3 inches in length, and parallel section at center 1 to 1½ inches wide by 9 inches in length. The percentage of elongation shall be measured in a gage length of 8 inches.

(b) Where specimens are to be tested on the testing machines of the Coast Guard, they shall be 1 inch wide at parallel section in center, and shall not exceed 2 inches in width on the ends.

(c) All bend test specimens shall be at least 12 inches in length and from 1 to 3½ inches in width, and the full thickness as rolled. The edges may be planed. The corners shall not be rounded, but the sharpness may be removed with a fine file. After bending, the specimens shall show no cracks or flaws on the outside of the bent portion.

(d) Two tension tests and one cold-bend test shall be made from each plate as first rolled from a billet, slab, or ingot, the tensile test specimens to be taken from two diagonal corners of the plate, and a cold-bend specimen to be taken transversely from the middle of the top of the plate.

(e) The bend test specimen shall bend cold 180 degrees around a pin without showing any sign of cracking or other injurious defects on the outside of the bent portion, as follows: For plates under 1 inch in thickness the diameter of the pin shall be equal to one and one-half times the thickness of the plate; for plates 1 inch and over, up to and including 1½ inches in thickness, the diameter of the pin shall be equal to three times the thickness of the plate, and for all plates over 1½ inches in thickness the diameter of the pin shall be equal to four times the thickness of the plate.

(f) The finished material shall be free from all injurious defects, and shall have a good and workmanlike finish.

(g) All measurements of test specimens and material shall be made by any standard American gage, and record of tests shall be submitted on Form CG–934.

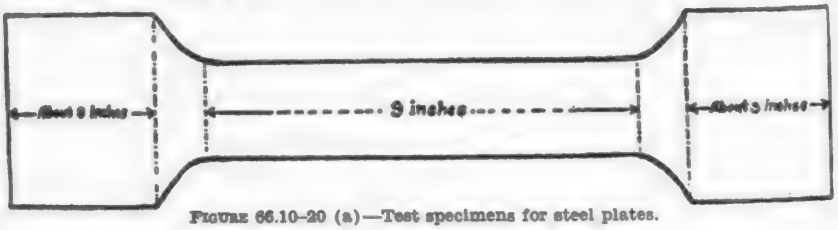


FIGURE 66.10–20 (a)—Test specimens for steel plates.

## Subpart 66.15—Steel Bars for Stays and Braces

### § 66.15–1 Tests and inspection.

All steel bars to be used as stays or braces in marine boilers shall be of Class A tested material.

### § 66.15–5 Physical properties.

The minimum tensile strength shall be not less than 58,000 pounds per square inch. The elongation shall be not less than 28 percent in 2 inches or 25 percent in 8 inches.

### § 66.15–10 Tension- and bend-tests.

(a) Two tension-test pieces and two bend-test pieces shall be taken from each heat. The full-size bars within the capacity of the testing machine may be used for tensile tests. Where the full size of the bar is too large for the capacity of the testing machine, the bar may be reduced in size to meet such capacity. To facilitate and insure accurate tests, all bars for tensile and bending tests may be reduced in size.

(b) The minimum tensile strength of each piece shall be not less than 58,000 pounds per square inch of section and each test piece that has been reduced in size shall show an elongation of at least 28 percent in 2 inches. Where the full size of the bar has been used for testing, the test pieces shall show an elongation of at least 25 percent in 8 inches. When the tensile strength of the test piece is more than 63,000 pounds, per square inch of section, each test piece that has been reduced in size shall show an elongation of at least 26 percent in 2 inches. Where the full size of the bar has been used for testing, each test piece shall show an elongation of at least 22 percent in 8 inches.

(c) The pieces for the bend test shall be bent cold to a curve, the inner radius of which is equal to one and one-half times the diameter of the bar without flaws or cracks.

(d) Should any such test bar fail in either the tensile or bending test, no bars from such heat shall be allowed to be used in the construction of any marine boiler. Where a heat of steel bars has been passed by an inspector, separate lots of bars from such heat may be furnished to different boiler manufacturers upon a certificate from the mill that the bars were made from such accepted heat.

### § 66.15–15 Manufacturer's affidavit covering tested stays.

Boiler manufacturers desiring to use tested stays or braces shall be required to furnish the inspectors with the following form of affidavit, duly filled in:

(Form CG–937)

STATE OF _____
*County of* _____
I hereby certify that I am the _____ _____ of the
(State "owner" or name position)
steam boiler works named _____ _____, situated at _____, in the State of _____, and that the lot or lots of steel bars from which the test bars were taken and tested by the inspector on the _____ day of _____, 19____, and allowed for use in the steam boiler to be constructed for the steamer _____, and to be allowed a strain not to exceed _____ pounds per square inch of section as a working steam pressure, will be used in the construction of the boiler ____ for the steamer _____, and no material for any braces, stays, or stay bolts required to be made of tested material and to carry a strain equal to _____ pounds per square inch of section will be used as braces, stays, or stay bolts in the construction of the boiler ____ for the said steamer tested by the inspector and approved by him in accordance with the requirements of law.

(Signature) _____
Subscribed and _____ to before
(Sworn or affirmed)
me this _____ day of _____, 19____.
[SEAL] (Signature) _____
*Notary Public.*

## Subpart 66.20—Lapwelded Boiler Tubes

### § 66.20–1 Process.

(a) All lapwelded boiler tubes up to and including 4 inches in diameter shall be made of charcoal iron, or mild steel made by any process.

(b) All lapwelded boiler tubes over 4 inches in diameter, up to and including 30 inches in diameter, shall be made of wrought iron or mild steel, made by any process.

(c) Tubes shall be free from defective welds, cracks, blisters, scale, pits, and sand marks.

### § 66.20–5 Tests.

(a) The following tests shall be made on lapwelded boiler tubes up to and including 4 inches in diameter:

(1) A test piece 2 inches in length cut from a tube shall stand being flattened by hammering until the sides are brought parallel and separated by a distance not greater than one-third the outside diameter of the tube, without showing cracks or flaws, the weld being 45 degrees from the bend.

(2) A second tube shall have a flange turned over at right angles to the body of the tube and shall have a width equal to ⅜ inch. Tubes less than 3 inches in diameter shall only be required to have a flange turned equal to one-eighth of the diameter of the tube. This test shall not be applied to threaded stay tubes.

(3) All the work shall be done cold.

(4) Each tube shall stand an internal hydrostatic pressure of 1,000 pounds per square inch and be struck near both ends while under pressure with a 2-pound hammer or its equivalent without showing signs of weakness or defects.

(5) All steel tubes, except those made of open-hearth steel, shall have the ends properly annealed by the manufacturer before shipment.

(6) All tubes shall stand expanding, flanging over on the tube plate, and beading without flaws, cracks, or opening at the weld, except threaded stay tubes.

(b) The following tests shall be made on lapwelded boiler tubes over 4 inches in diameter, up to and including 30 inches in diameter:

(1) A test piece, 2 inches in length, cut from a tube, shall stand being flattened by hammering until the sides are brought parallel and separated by a distance not greater than one-third the outside diameter of the tube, without showing cracks or flaws, with the weld being 45 degrees from the bend.

(2) Each tube shall stand an internal hydrostatic pressure of 500 pounds per square inch and shall be struck near both ends while under pressure with a 2-pound hammer or its equivalent without showing signs of weakness or defects.

(3) All steel tubes except those made of open-hearth steel shall have ends properly annealed by the manufacturer before shipment.

(4) All tubes shall stand drilling, riveting, and calking, and work necessary to install them into the tube head without showing any weakness or defects.

## Subpart 66.25—Seamless Steel Boiler Tubes

### § 66.25–1 Process.

The steel shall be made by the open-hearth process.

### § 66.25–5 Finish.

Tubes shall be free from all surface defects. The defects to be particularly avoided in seamless tubes are tears, snakes, checks, slivers, scratches, laps, pits, rings, and sinks.

### § 66.25–10 Heat treatment.

All seamless steel cold-drawn tubes shall be annealed as a final process. One or more tubes shall be selected at random from each charge of annealing furnace, and coupons cut from same for testing.

### § 66.25–15 Tests.

(a) A piece 3 inches long cut from the first tube shall stand being flattened cold by hammering until the sides are brought parallel and separated by a distance not greater than one-third the outside diameter of the tube, without showing cracks or flaws.

(b) A flange shall be turned cold all around the end of the tube to a width equal to ⅜ inch beyond the outside body of the tube. Tubes less than 3 inches in diameter shall only be required to have a flange turned equal to one-eighth of the diameter of the tube. This test shall not be applied to threaded stay tubes.

(c) Where hot-finished tubes are furnished, the tubes shall pass the same manipulating tests as cold-drawn tubes and shall be subject to the same conditions as to gage, but do not have to be annealed.

(d) Each tube shall be subject to an internal hydrostatic pressure of 1,000 pounds per square inch without showing signs of weakness or defects.

(e) All tubes, except threaded stay tubes, shall stand expanding, flanging over on the tube plate, and beading without flaw or crack.

(f) All tubes shall be carefully gaged and shall not be less than the specified thickness.

### § 66.25–20 Statement or certificate of manufacturer of boiler tubes.

When the manufacturers of boiler tubes file with the Commandant a cer-

tificate duly sworn to that all tubes manufactured by them will stand the tests and meet all the requirements of this part, they shall be accepted by inspectors of the Coast Guard and no other affidavit will be required.

## Subpart 66.30—Welded Steel and Iron Pipe

### § 66.30–1 Process.

The pipe material shall be made by the open-hearth or the bessemer process. Welded pipe shall be made by the hammer-weld process.

### § 66.30–5 Physical properties.

(a) *Bessemer steel pipe.* Tensile strength, minimum, 50,000 p.s.i. Elongation in 8 inches, minimum, 20 percent.

(b) *Open-hearth steel pipe.* Tensile strength, minimum, 45,000 p.s.i. Yield point, minimum, 25,000 p.s.i. Elongation in 8 inches, minimum, 20 percent.

(c) *Wrought-iron pipe.* Tensile strength, minimum, 40,000 p.s.i. Yield point, minimum, 24,000 p.s.i. Elongation in 8 inches, minimum, 12 percent.

### § 66.30–10 Tension tests.

(a) Tension tests are not required for pipes up to and including 3½ inches in diameter.

(b) For all diameters exceeding 3½ inches, tension tests shall be made from every 50 pieces furnished, or fraction thereof, and shall show the following results:

(1) *For bessemer steel.* Tensile strength, not less than 50,000 pounds per square inch. Elongation in 8-inch specimen, not less than 20 percent.

(2) *For open-hearth steel.* Tensile strength, not less than 45,000 pounds per square inch. Elongation in 8-inch specimen, not less than 20 percent.

(3) *For iron.* Tensile strength, 40,000 to 48,000 pounds per square inch. Elastic limit, 22,000 to 30,000 pounds per square inch. Elongation in 8-inch specimen, not less than 12 percent.

### § 66.30–15 Flattening tests.

(a) Flattening tests are not required for pipe up to and including 3½ inches in diameter.

(b) For all diameters greater than 3½ inches inside, flattening tests shall be made as follows:

(1) *Steel.* A test piece 2 inches in length cut from a pipe shall stand being flattened by hammering until the sides are brought parallel with the curve on the inside at the ends not greater than one-third the outside diameter of the pipe without showing cracks or flaws, the weld being 45 degrees from the curve.

(2) *Iron pipe.* A test ring three times the thickness in length cut circumferentially from lapwelded wrought-iron pipe shall be crushed down to an inner diameter of one-third the outside diameter of the pipe. Wrought-iron pipe will not stand this test without fracture, but no lapwelded wrought-iron pipe shall be accepted where the break is short or crystalline or shows evidence of defective material or bad welding, and in every case the fiber of the iron shall be shown.

### § 66.30–20 Hydrostatic tests.

(a) Pipes ⅛ inch inside diameter up to and including 3½ inches inside diameter shall be tested before shipment to 600 pounds per square inch hydrostatic pressure.

(b) All pipe above 3½-inch diameter shall be tested before shipment to not less than 500 pounds per square inch hydrostatic pressure.

### § 66.30–25 Finish.

(a) The pipe shall be smooth, straight, and free from defects.

## Subpart 66.35—Seamless Steel Pipes

### § 66.35–1 Process.

(a) The steel shall be made by the open-hearth process.

### § 66.35–5 Physical properties.

(a) Tensile strength, minimum, 48,000 pounds per square inch. Yield point, minimum, 26,500 pounds per square inch. Elongation in 2 inches, minimum, 40 percent.

### § 66.35–10 Flattening test.

(a) A test piece 2 inches in length cut from a pipe, shall stand being flattened by hammering until the sides are brought parallel with the curve on the inside at the ends not greater than one-third the outside diameter of the pipe without showing cracks or flaws.

### § 66.35–15 Tension tests.

(a) Tension tests shall be made from every 50 pieces furnished, or fraction thereof, and shall show the following results:

(1) Tensile strength, not less than 48,000 pounds per square inch.

(2) Elongation in 8-inch specimen, not less than 12 percent.

### § 66.35–20 Marking.

(a) The name or brand of the manufacturer shall be legibly rolled in raised characters or stamped on the outer surface of each pipe.

### § 66.35–25 Finish.

(a) Pipe shall be free, inside and outside, from all surface defects that would materially weaken it or form starting points of corrosion. The defects to be especially avoided are snakes, checks, slivers, laps, pits, etc. Pipe shall be smooth and straight.

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# PART 67—CONSTRUCTION

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AUTHORITY: The provisions of this Part 67 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426–4431, as amended, 4433, as amended, 4434, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404–409, 411, 412, 435, 481, 489, 366, 395, 363, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July

31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 16, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857.

## Subpart 67.01—Procedure and General Requirements

### § 67.01–1 Definitions.

(a) *Main boiler.* A main boiler is a steam boiler used for generating steam for propulsion purposes on shipboard.

(b) *Auxiliary boiler.* An auxiliary boiler is a steam boiler used for all purposes on shipboard for which steam may be required other than propulsion.

(c) *Donkey boiler.* A donkey boiler is a steam boiler installed on a vessel for occasional use for any purpose for which steam is required other than propulsion.

(d) *Pressure vessel.* A pressure vessel is an unfired vessel containing gases, vapors, or liquids under pressure. (See Part 54 of Subchapter F (Marine Engineering) of this chapter.)

(e) *Water-tube boiler.* A water-tube boiler is a steam boiler in which the boiler tubes contain water and steam, the heat being applied to the outside surface of the tubes and is composed generally of drums, headers, and tubes.

(f) *Internally-fired fire-tube boiler.* (Scotch) An internally-fired fire-tube boiler is a steam boiler containing furnaces, one or more combustion chambers and tubes or flues which are surrounded by water and through which the products of combustion pass from the furnace to the uptake. In such boilers no part of the shell is in contact with the fire or products of combustion.

(g) *Externally-fired fire-tube or flue boilers.* (Horizontal return tubular) An externally fired and fire-tube or flue boiler is a steam boiler, part of the outer shell of which is exposed to fire or to the products of combustion, and containing flues through which such products pass from the furnace to the uptake.

(h) *Porcupine boiler.* A porcupine boiler is a steam boiler consisting of a vertical shell from which project a number of dead end tubes.

(i) *Factor of safety.* Factor of safety is the ratio of the ultimate strength of the material to the stress maximum allowable.

(j) *Pressure of p. s. i.* Pressure of p. s. i. is the gage pressure or the pressure above the atmospheric pressure in pounds per square inch.

(k) *Design pressure.* Design pressure is the theoretical bursting pressure of the weakest part of a boiler, pressure vessel, or piping divided by its factor of safety.

(l) *Maximum allowable pressure.* The maximum allowable pressure of a boiler and superheater shall be considered as the highest setting of the safety valves.

(m) *Repair.* Repair is the restoration of any damaged or impaired part to an effective and safe condition.

(n) *Alteration.* Alteration is a structural modification of or departure from an approved design or existing construction.

### § 67.01–5 Drawings.

(a) The manufacturer of any boiler to be used for marine purposes shall furnish the Officer in Charge, Marine Inspection, where such boiler or boilers are to be inspected duplicate blueprints or tracings fully descriptive of same in detail for his approval, one of which shall be kept on file in the inspection office and the other returned to the manufacturer. Where more than one boiler is made from a similar design, a drawing of which is on file in the inspection office, if made at a different date, a reference to such drawing on file is all that shall be required. The manufacturer shall also furnish the Officer in Charge, Marine Inspection, an affidavit on either Form CG–935 or CG–936.

(b) Duplicate blueprints or drawings of water-tube and coil boilers, with their specifications, shall be submitted for approval of the Commandant (under R. S. 4429, 46 U. S. C. 407), and the design approved by the Commandant, before the boilers will be allowed to be used on any vessel coming under the jurisdiction of the Coast Guard. After the approval of the design by the Commandant, 60 certified sets of the blueprints or drawings shall be furnished the Commandant for the use of the inspectors. The blueprints or drawings necessary to comply with the foregoing provisions shall be supplied by the manufacturers. Manufacturers shall furnish Officers in Charge, Marine Inspection, where boilers are to be installed an affidavit certifying that the boilers are constructed in accordance with the specification approved by the Commandant.

(c) Contractors intending to repair boilers, unfired pressure vessels or appliances installed on vessels subject to inspection by the Coast Guard, shall submit detail drawings in triplicate which shall be fully descriptive of the repair parts of such boilers, unfired pressure vessels, or appliances, to the Officer in Charge, Marine Inspection, having jurisdiction over the vessel. When due to location of the shipyard or design office, such a procedure would result in unnecessary delay in transmission, the drawings may be forwarded directly to the Commandant (MMT), U.S. Coast Guard, Washington, D.C., 20226.

### § 67.01–10 Computations.

It shall be the duty of every Officer in Charge, Marine Inspection, to make, for every new boiler inspected in his district, all computations required by the rules and regulations, and any other necessary computations, from data obtained from blueprints or tracings, boiler manufacturers' affidavits, tensile test reports, and from other reliable sources. A record of such computations in full shall be made on letter sheets and filed with blueprints or tracings of boiler, the first sheet of such computations to be headed with a general description of boiler and with the vessel file number.

### § 67.01–15 Appeals.

In case the repair is disapproved by the Officer in Charge, Marine Inspection, the manufacturer may appeal within 30 days to the Coast Guard District Commander of the district, and should the Coast Guard District Commander sustain the Officer in Charge, Marine Inspection, the manufacturer may further appeal within 30 days to the Commandant. The decision of the Commandant shall be final.

### § 67.01–20 Materials and workmanship.

All materials to be used for repairs, replacements and for alterations shall be free from injurious defects and shall have a workmanlike finish. The work shall be executed in a workmanlike manner with proper tools or equipment and shall be free from defects which would impair strength or durability.

### § 67.01–25 Alternative materials or methods of repair.

If, in the development of industrial arts, improved materials or methods of repair are developed, their use in lieu of those specified will be given consideration upon formal application to the Commandant, with full information as to their characteristics, together with such scientific data and evidence as may be necessary to establish the suitability of such materials or methods of repair for the purpose intended.

### § 67.01–30 Repairs, replacements, or alterations.

(a) No repairs, replacements, or alterations, except emergency repairs, etc., shall be made to boilers, pressure vessels, their mountings or internal fittings, safety valves, piping systems, or pressure appliances without prior approval by the Officer in Charge, Marine Inspection.

(b) Boilers built and installed prior to July 1, 1935, may be repaired with materials and in the same manner specified in this subchapter, except that the use of cast iron valves, mountings, or attachments for repairs, replacements, or alterations on existing boilers operating at pressures exceeding 30 pounds per square inch is prohibited. Emergency repairs, replacements, or alterations shall be reported as soon as practicable to the Officer in Charge, Marine Inspection, at or nearest the first port where the vessel may call after such repairs are made.

### § 67.01–35 Boilers built since February 28, 1872.

Boilers built since February 28, 1872, of material stamped and tested according to the requirements of R.S. 4430 (46 U.S.C. 408), and having a record thereof in the office of the Officer in Charge, Marine Inspection, in the district where the boiler was built or intended to be used, may be used for marine purposes, notwithstanding that such boilers may have been used for other purposes, if in the judgment of the Officer in Charge, Marine Inspection, they are deemed safe.

### § 67.01–40 Inspectors' decisions.

When it becomes necessary for inspectors to make decisions on certain matters covered by the regulations in this subchapter, they shall in making their reports quote the section and paragraph

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number on which their decisions are based. Whenever it is necessary to make decisions in matters not specifically covered by the regulations in this subchapter, they shall in making their reports state clearly the reasons which caused them to arrive at such decisions.

## Subpart 67.05—Cylindrical Shells

### § 67.05–1 Definitions.

(a) *Cylindrical shell.* The term "cylindrical shell," as used in this subchapter means the cylinder forming the outer envelope of a boiler or other pressure vessel, or of a drum which is a part of a boiler consisting of one or more plates properly riveted, welded, or otherwise joined or of seamless construction as hereinafter specified.

(b) *Course.* A course is a section of a cylindrical shell which comes between circumferential joints.

### § 67.05–5 Materials.

(a) Plates shall be of boiler steel complying with Subpart 66.10 of this subchapter.

(b) Seamless steel pipe or tubing made by the open-hearth process may be used for shells in the construction of steam and water drums for boilers when the inside diameter of such drums does not exceed 24 inches, provided that the material conforms to the requirements of Subpart 66.35 of this subchapter.

(c) Welded steel pipe of material made by the open-hearth process may be used in the construction of drum shells, provided that the joints are made by the hammer-weld process and the material conforms to the requirements of Subpart 66.30 of this subchapter.

(d) Welded wrought-iron pipe may be used in the construction of drum shells, provided the joints are made by the hammer-weld process and the material conforms to the requirements of Subpart 66.30 of this subchapter.

(e) Copper or brass may be used in the construction of steam drums not exceeding 14 inches in diameter, of a thickness of material not less than five-eighths of an inch, and on the construction of steam drums 12 inches in diameter and under having a thickness of material of not less than ½ inch. All tubes and drums referred to in this paragraph shall be made from ingots or blanks drawn down to size without a seam. Water-tube boilers or generators so constructed may be used for marine purposes with none other than liquid fuel.

(f) Manufacturers furnishing steel piping or tubing for the construction of steam or water drums shall submit a certification that the material furnished conforms to the physical requirements specified in Subpart 66.35 of this subchapter.

### § 67.05–10 Computations.

(a) *Riveted cylindrical shells.* (1) The maximum allowable pressure on cylindrical shells of boilers constructed of plates inspected as required by this subchapter when single riveted, shall not produce a stress to exceed one-sixth of the tensile strength of the iron or steel plates of which such boilers are constructed; but where the longitudinal laps of the cylindrical parts of such boilers are double riveted, and the rivet holes for such boilers have been fairly drilled instead of punched, an addition of 20 percent to the maximum allowable pressure provided for single riveting shall be allowed.

(2) The maximum allowable pressure for any dimension of boilers shall be ascertained by the following rule, viz: Multiply one-sixth of the lowest tensile strength found stamped on the plates in the cylindrical shell by the thickness, expressed in inches or parts of an inch, and divide by the radius or half diameter, also expressed in inches; and the result will be the pressure allowable per square inch of surface for single riveting, to which add 20 percent where the longitudinal laps of the cylindrical parts of such boiler are double riveted, when all the rivet holes of such boiler, including steam and mud drums, have been fairly drilled and no part of such holes has been punched. The pressure allowed shall be based on the plate whose tensile strength multiplied by its thickness gives the lowest product.

(b) *Seamless or welded drums.* (1) The maximum allowable working pressure and minimum thickness of seamless or welded drums shall be computed from the following formulas:

$$P=\frac{S\times T\times E}{R\times F} \qquad (1)$$

$$T=\frac{P\times R\times F}{S\times E} \qquad (2)$$

where:

$P$ = maximum allowable working pressure, in pounds per square inch.
$T$ = thickness of shell in inches.
$S$ = minimum tensile strength of material in pounds per square inch.
$R$ = inside radius of shell in inches.
$F$ = factor of safety, which is 6.
$E$ = efficiency of join or ligament between tube holes, whichever is the least.

(2) Where seamless piping or tubing is used, the value of $E$ shall equal 1, except in cases where the shell is pierced for tube holes, in which case the value of $E$ shall equal the percentage of strength of the ligament between the tube holes as compared with the solid plate.

(3) Where reinforcing plates are used to strengthen the shell at the point where the tube enters, they shall be riveted to the shell and the value of $E$ shall be determined in the following manner:

(i) The efficiency of the plate section or ligament between tube holes, or

(ii) The shearing strength of the rivets securing the plate to the shell, whichever value is the least.

(4) Where welded piping is used for drum shells as specified in preceding paragraphs, the value of $E$ shall be taken at 0.7, except where the shell is pierced for tube holes and the strength of the ligament falls below 70 percent, in which case the value of $E$ shall be the percentage of strength of the ligament between the tube holes as compared with the solid plate.

(5) Where reinforcing plates are used to strengthen the shell of such welded drums at the point where the tube enters, and the efficiency of the ligament between tube holes or the shearing strength of the rivets securing the reinforcing plate to the shell falls below 70 percent of the strength of the solid plate, the value of $E$ shall be determined in the following manner:

(i) The efficiency of the plate section or ligament between tube holes, or

(ii) The shearing strength of the rivets securing the plate to the shell, whichever value is the least.

(c) *Water-tube or coil boilers.* (1) The maximum allowable pressure on cylindrical shells of water-tube or coil boilers, when such shells have a row or rows of pipes or tubes inserted therein, shall be determined by the following formula: *Provided,* That the pressure allowable on such shells shall also be determined by the rule for cylindrical shells of boilers constructed of inspected plates conforming to Subpart 66.10 of this subchapter, and the lower pressure allowable by the two rules shall be taken:

$$P=\frac{(D-d)\times T\times S}{D\times R} \qquad (3)$$

where:

$P$ = maximum allowable pressure, in pounds per square inch.
$D$ = distance between the tube or pipe centers in a line from head to head, in inches.
$d$ = diameter of hole, in inches.
$T$ = thickness of plate, in inches.
$S$ = one-fourth of the tensile strength of the plate, in pounds per square inch.
$n$ = radius of shell, in inches.
$R$ = number of tube holes in a pitch.

(2) When tubes on any one row are pitched unequally, $nd$ must be substituted in the formula (3) for $d$.

(3) Where rows of tubes are pitched diagonally, each diagonal ligament shall not be less than three-fifths of each longitudinal ligament.

(d) *Porcupine-type Boilers.* (1) The formula for determining the maximum allowable pressure on boilers of the so-called porcupine and similar types shall be in accordance with this paragraph.

(2) Multiply the vertical distance between the centers of the horizontal rows of tubes in inches by one-half the diameter of shell of boiler in inches, which gives the area upon which the pressure is exerted to break a diagonal ligament, then find the sectional area of the ligament at its smallest part and multiply by one-sixth the tensile strength of the material. This result divided by the area upon which the strain is exerted gives the maximum allowable pressure as follows:

$$P=\frac{STE}{CD} \qquad (4)$$

where:

$P$ = maximum allowable pressures, in pounds per square inch.
$E$ = width of the ligament, in inches.
$T$ = thickness of the material, in inches.
$S$ = one-sixth of the tensile strength, in pounds per square inch.
$C$ = distance between vertical centers, in inches.
$D$ = one-half the inside diameter of the shell of central column, in inches.

## Subpart 67.10—Shell Joints

### § 67.10–1 Approved types of joints.

(a) Joints of shells of boilers or other pressure vessels are classified as follows:

(1) Riveted joints, which may be either lapped or butt-strapped.

(2) Welded joints, which shall be made by the hammer-weld or other approved process.

### § 67.10–5 Workmanship.

(a) Centers or guide holes not to exceed 75 percent of the diameter of the full-size finished hole for tubes and stays may be punched. The remainder shall be cleanly cut, drilled, or reamed to full size. Holes not to exceed 4 inches in diameter in plates five-eighths of an inch thick and under may be punched to within ½ inch of the full diameter of the finished hole; the remainder shall be cleanly cut, drilled, or reamed to full size.

### § 67.10–10 Riveted joints.

(a) The diameter of rivets, rivet holes, distance between centers of rivets, and distance from centers of rivets to edge of lap for different thicknesses of plates for single and double riveting shall be determined by the rules in this section.

(b) The formulas in this section, equivalent to those of the British Board of Trade, are given for the determination of the pitch, distance between rows of rivets, diagonal pitch, maximum pitch, and distance from centers of rivets to edge of lap of single and double riveted lap joints, for both iron and steel boilers.

(c) (1) To determine the pitch for iron plates and iron rivets:

$$p=\frac{d^2\times 0.7854\ X\ n}{T}+d \qquad (1)$$

(2) To determine the pitch for steel plates and steel rivets:

$$p=\frac{23\times d^2\times 0.7854\ X\ n}{28\times T}+d \qquad (1a)$$

(d) To determine the distance from center of rivet to edge of lap:

$$E=\frac{3\times d}{2} \qquad (2)$$

(e) To determine the distance between rows of rivets:

(1) The distance between lines of centers of rows of rivets for double, chain-riveted joints ($V$) shall not be less than twice the diameter of rivet, but it is more desirable that $V$ should not be less than:

$$\frac{4d+1}{2} \qquad (3)$$

(2) For ordinary, double zigzag riveted joints:

$$V=\frac{\sqrt{(11p+4d)\ (p+4d)}}{10} \qquad (4)$$

(f) To determine the diagonal pitch for double, zigzag riveted lap joint; iron and steel:

$$p_d=\frac{6p+4d}{10} \qquad (5)$$

(g) To determine the maximum pitches for riveted lap joints:

(1) For single-riveted lap joints:

Maximum pitch $=(1.31\times T)+1\frac{5}{8}$ (6)

(2) For double-riveted lap joints:

Maximum pitch $=(2.62\times T)+1\frac{5}{8}$ (7)

where:

$p$ = greatest pitch of rivets, in inches.
$n$ = number of rivets in one pitch.
$p_d$ = diagonal pitch, in inches.
$d$ = diameter of rivets, in inches.
$T$ = thickness of plate, in inches.
$V$ = distance between rows of rivets, in inches.
$E$ = distance from edge of plate to center of rivet, in inches.

(h) To determine the pitch of rivets from the formulas in this section, use the diameter and area of the rivet holes. The diameter of the rivets is the diameter of the driven rivet.

(i) Any riveted joint shall be allowed when it is constructed so as to give an equal percentage of strength to that obtained by the use of the formula given.

### § 67.10–15 Butt straps.

(a) Where butt straps are used in the construction of marine boilers, the straps for single butt strapping shall in no case be less than the thickness of the shell plates; and where double butt straps are used, the thickness of each shall in no case be less than five-eighths the thickness of the shell plates.

### § 67.10–20 Welded joints.

(a) Where welded drums are used, the joint shall be so located as not to be in contact with the products of combustion, and shall not be pierced for tube holes.

## Subpart 67.15—Heads

### § 67.15–1 Definitions.

(a) *Unstayed heads.* Unstayed heads are the ends of a pressure vessel shell. They may be either flat or dished. Heads may be integral with, riveted, welded, or brazed to the shell.

(b) *Unstayed flat heads.* Unstayed flat heads may be used to close shells as permitted by the regulations in this subchapter.

(c) *Dished heads.* Dished heads may be of circular or elliptical section and may be attached to the shell so that the pressure will be either on the concave or on the convex surface.

(d) *Stayed heads.* Stayed heads are heads supported in whole or in part by stays, furnaces, flues, tubes, etc.

### § 67.15–5 Materials and workmanship.

(a) Material used in the construction of all bumped heads shall possess the physical and chemical qualities prescribed by the Commandant for all plates subject to tensile strain, as required by R.S. 4430 (46 U.S.C. 408).

(b) To avoid grooving the flanging shall be well rounded at the bend.

(c) Bumped heads may contain a manhole opening flanged inwardly, when such flange is turned to a depth of three times the thickness of material in the head.

(d) All drums attached to coil, pipe, sectional, or water-tube boilers not already in use or actually contracted for, to be built for use on a steam vessel, and their building commenced at or before the date of this rule, shall be required to have the heads of wrought iron or steel or cast steel flanged and substantially riveted to the drums or secured by bolts and nuts of equal strength with rivets, in all cases where the diameters of such drums exceed 6 inches.

(e) Drums and water cylinders constructed with a bumped head at each or either end, any opening in the shell or heads to be reinforced as required by the rules of the Commandant, the circumferential and horizontal seams to be welded and properly annealed after such welding is completed, and when tested with a hydrostatic pressure of at least double the amount of the steam pressure allowed may be used for marine purposes.

### § 67.15–10 Computations.

(a) *Convex heads.* All plates used as heads, when new and made to practically true circles, and as described below, shall be allowed a maximum pressure in accordance with the following formula:

$$P=\frac{T\times S}{R} \qquad (1)$$

where:

$P$ = Maximum allowable pressure, in pounds per square inch.
$T$ = thickness of plate, in inches.
$S$ = one-fifth of the tensile strength, in pounds per square inch.
$R$ = one-half of the radius to which the head is bumped, in inches.

(b) *Concave heads.* For concave heads the pressure allowable shall be eight-tenths times the pressure allowable for convex heads.

NOTE: To find the radius of a sphere of which the bumped head forms a part, square the radius of head, divide this by the height of bump required; to the result add height of bump, which will equal diameter of sphere, one-half of which will be the required radius.

(c) *Flat heads of wrought-iron or steel plate.* (1) Where flat heads do not exceed 20 inches in diameter they may be used without being stayed, and the maximum pressure allowable shall be determined by the following formula: *Provided,* That flanges are made to an inside radius of at least 1½ inches:

$$P=\frac{C\times T^2}{A} \qquad (2)$$

where:

$P$ = maximum allowable pressure, in pounds per square inch.
$T$ = thickness of material in sixteenths of an inch.
$A$ = one-half the area of head, in square inches.
$C$ = 112 for plates seven-sixteenths of an inch and under.
$C$ = 120 for plates over seven-sixteenths of an inch.

(d) *Requirements for heads (applicable only to rivers).* (1) All heads employed in the construction of cylindrical externally fired boilers for steamers navigating the Red River of the North and rivers whose waters flow into the Gulf of Mexico shall have a thickness of material as follows:

(i) Over 32 inches and not over 36 inches, not less than ½ inch.

(ii) Over 36 inches and not over 40 inches, not less than 9/16 inch.

(iii) Over 40 inches and not over 48 inches, not less than ⅝ inch.

(iv) Over 48 inches, not less than ¾ inch.

(2) The heads of steam and mud drums of such boilers shall have a thickness of material of not less than half an inch.

## Subpart 67.20—Openings and Reinforcements

### § 67.20–1 Material.

(a) The cover plates for manholes and handholes should be of steel conforming to the specifications and requirements for steel plates.

(b) Cast steel may also be used in the construction of manhole and handhole plates.

### § 67.20–5 Manhole openings.

(a) Manhole openings in front head of externally fired boilers under the flues, as required by R.S. 4434 (46 U.S.C. 412), shall be of dimensions of not less than 8 by 12 inches in the clear. Applicable to steamers navigating rivers only.

(b) All boilers built on and after August 1, 1914, shall have a manhole opening above the flues or tubes of not less than 10 by 16 inches, 11 by 15 inches, or of an equal area, in the clear, and shall have such other manhole openings in other parts of the boiler as may be required by the Officer in Charge, Marine Inspection, when considering blueprints or tracings submitted to him for approval of sufficient dimensions to allow easy access to the interior of the boiler for the purpose of inspection and examination.

### § 67.20–10 Reinforced openings.

(a) When holes exceeding 6 inches in diameter are cut in boilers for pipe connections, manhole and handhole plates, such holes shall be reinforced, either on the inside or outside of boiler, with reinforcing wrought-iron steel rings, which shall be securely riveted or properly fastened to the boiler, such reinforcing material to be rings of sufficient width and thickness of material to fully compensate for the amount of material cut from such boilers, in flat surfaces; and where such opening is made in the circumferential plates of such boilers, the reinforcing ring shall have a sectional area equal to at least one-half of the sectional area of the opening parallel with the longitudinal seams of such portion of the boiler. On boilers carrying 75 pounds or less steam pressure a cast-iron stop valve, properly flanged, may be used as reinforcement to such opening. When holes are cut in any flat surface of such boilers and such holes are flanged inwardly to a depth of not less than 1½ inches, measuring from the outer surface, the reinforcement rings may be dispensed with.

(b) When reinforcing rings as described above are made of wrought-iron or steel, the material shall not be required to be tested.

(c) Seamless forged steel nozzles may be used for reinforcing holes cut in boilers when the amount of material in the flange of the saddle that is secured to the boiler is equal to the amount of material removed from the boiler.

(d) No connection between shell of boiler and mud drum shall exceed 9 inches in diameter and the flange of the mud-drum leg shall consist of an equal amount of material to that cut out of the shell of boiler.

## Subpart 67.25—Stays and Stayed Surfaces

### § 67.25–1 Definitions.

(a) *Through stay.* Through stay is a solid bar extended through both heads of a boiler and threaded at the ends for attachment by means of nuts. With this type of stay the ends are usually upset to compensate for the threading. (See Figure 67.25–1(a).)

(b) *Solid staybolt.* Solid staybolt is a threaded bar screwed through the plates, the ends being riveted over or fitted with nuts or welded collars. (See Figure 67.25–1 (b).)

(c) *Hollow staybolt.* Hollow staybolt is a hollow threaded bar screwed through the plates, the ends being riveted over or fitted with nuts or welded collars. (See Figure 67.25–1 (c).)

(d) *Flexible staybolt.* Flexible staybolt is a bar made with ball-and-socket joint on one end, the cup of the socket being screwed into the outside sheet and covered with a removable cap, the plain end of the staybolt being threaded, screwed through the inside sheet and riveted over. (See Figure 67.25–1 (d).)

(e) *Sling stay.* Sling stay is a flexible stay consisting of a solid bar having one or both ends forged for a pin connection to a crowfoot or other structural fitting secured to the stayed plate. (See Figure 67.25–1 (e).)

(f) *Crowfoot.* Crowfoot is a forged fitting with palms or lugs secured to the head to form a proper connection with a sling stay. (See Figure 67.25–1 (f).)

(g) *Crowfoot stay.* Crowfoot stay is a solid bar stay terminating in a forged fork with palms or lugs for attachment to the plate. (See Figure 67.25–1 (g).)

(h) *Diagonal stay.* Diagonal stay is a bar or formed plate forged with palms or lugs for staying the head of the boiler to the shell diagonally. (See Figure 67.25–1 (h).)

(i) *Gusset stay.* Gusset stay is a triangular plate used for the same purpose as a diagonal stay and attached to the head and the shell by angles, flanges, or other suitable means of attachment. (See Figure 67.25–1 (i).)

(j) *Dog stay.* Dog stay is a staybolt, one end of which extends through a girder, dog, or bridge, and is secured by a nut, the other end being screwed through the plate which it is supporting and riveted over or fitted with a nut or welded collar. (See Figure 67.25–1 (j).)

(k) *Girder.* Girder is a bridge, built up of plates or structural shapes separated by distance pieces, a forging, of a formed plate, which spans an area requiring support abutting thereon and supporting the girder stays or staybolts. (See Figure 67.25–1 (k).)

(l) *Welded collar.* Welded collar is a beveled ring formed around the end of a screw stay by means of arc or gas welding. It is used in lieu of a nut. (See Figure 67.25–1 (l).)

(m) *Reinforcement.* Reinforcement is a doubling plate, washer, structural shape, or other form for stiffening or strengthening a plate.

(n) *Stay tube.* Stay tube is a thick-walled tube used in fire-tube boilers to stay the tube sheets.

(o) *Telltale hole.* Telltale hole is a small hole having a diameter not less than 3/16 inch drilled in the center of a solid stay and extending to at least ½ inch beyond the inside surface of the sheet.

(p) *Stayed surfaces.* Surfaces to be stayed or reinforced include the following:

(1) Flat plates, heads, or areas thereof, such as segments of heads, wrapper sheets, furnace plates, side sheets, combustion chamber tops, etc., which are not self-supporting.

(2) Curved plates constituting the whole or parts of a cylinder subject to external pressure which are not entirely self-supporting.

### § 67.25–5 Materials and workmanship.

(a) All steel bars to be used as stays or braces in marine boilers and allowed a stress of 7,000, 8,000, or 9,000 pounds per square inch shall be tested by inspectors at the mills where the material is manufactured in compliance with Subpart 66.15 of this subchapter.

(b) Stay bolts and stays made of the best quality of refined wrought iron may be welded. The lengthening of steel stays by welding shall not be allowed.

(c) All screw stay bolts shall be drilled at the ends with a three-sixteenths-inch hole to at least a depth of one-half inch beyond the inside surface of the sheet. Stays through laps or butt straps may be drilled with larger hole to a depth so that the inner end of said larger hole shall not be nearer than the thickness of the boiler plates from the inner surface of the boiler. Hollow-rolled screw stay bolts may be used.

(d) Flexible stay bolts that are made with a ball in socket on one end, the socket screwed into the outside sheet and covered with a removable cap and bolt screwed into the inside sheet and riveted over, may be used for staying flat surfaces without being drilled with a telltale hole.

(e) Holes for screw stays shall be tapped fair and true, and full thread.

(f) The ends of stays which are upset to include the depth of thread shall be thoroughly annealed after being upset.

### § 67.25–10 Stays.

(a) The maximum allowable pressure for stays used in the construction of marine boilers where same are accurately fitted normal to supported surfaces and

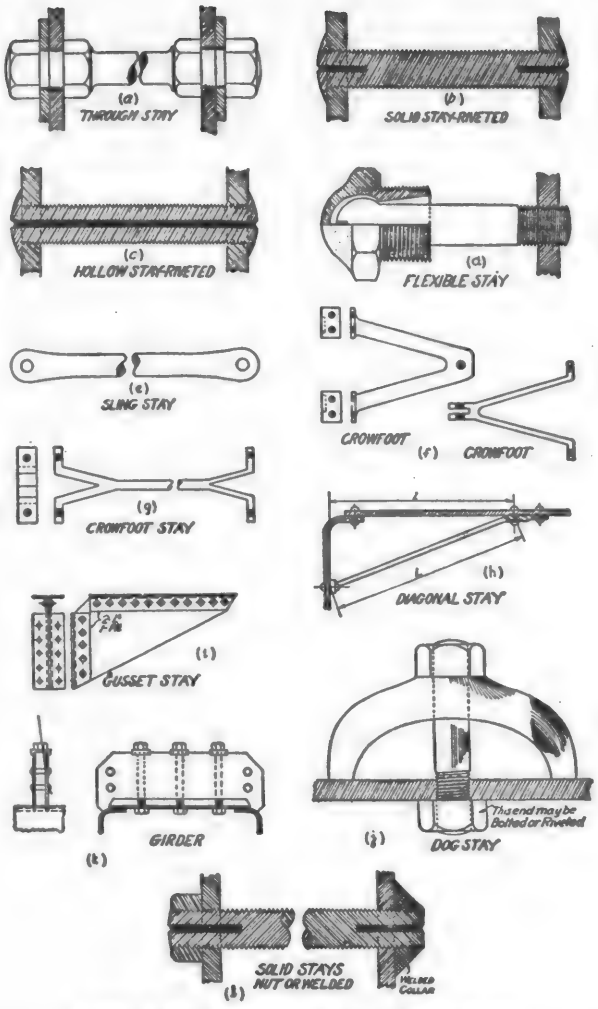


FIGURE 67.25–1—Acceptable types of boiler stays.

properly secured shall be ascertained by the following formula:

$$P=\frac{A\times C}{a} \qquad (1)$$

where:

$P$=maximum allowable pressure, in pounds per square inches.
$A$=least cross-sectional area of stay, in square inches.
$a$=area of surface supported by one stay, in square inches.
$C$=a constant.
$C$=9,000 for tested steel stays 1 inch and upward in diameter when such stays are not forged or welded. The ends may be upset to a sufficient diameter to allow for the depth of the thread. The diameter shall be taken at the bottom of the thread, provided it is the least diameter of the stay. All such stays after being upset shall be thoroughly annealed.
$C$=8,000 for a tested Huston or similar type of brace, the cross-sectional area of which exceeds 5 square inches.
$C$=7,000 for such tested braces when the cross-sectional area is not less than 1.227 and not more than 5 square inches, provided such braces are prepared at one heat from a solid piece of plate without welds.
$C$=7,500 for wrought-iron stays 1 inch and upward in diameter when made of the best quality of refined iron. The ends may be upset to allow for the depth of the thread. The diameter shall be taken at the bottom of the thread, provided it is the least diameter of the stay. Such stays may be welded.
$C$=6,000 for welded crowfoot stays when made of best quality of refined wrought-iron, and for all stays not otherwise provided for when made of the best quality of refined iron or of steel without welds.

(b) The required cross-sectional area of a diagonal or gusset stay shall be determined by the following formula:

$$A=\frac{a\times L}{l} \qquad (2)$$

where:

$A$=sectional area of diagonal stay, in square inches.
$a$=sectional area of direct stay, in square inches.
$L$=length of diagonal stay, in inches.
$l$=length of line drawn at right angles to boiler head or surface supported to center of palm of diagonal stay, in inches.

(c) When sling stays are connected by pins to angles secured to shell (see Figures 67.30–10(d) (1) and (2)), said angles shall be of sufficient depth to resist shear. Section to resist shear shall be determined by the following formulas:

$$A=D\times 2T \qquad (3)$$

$$D=\frac{A}{2T} \qquad (4)$$

where:

$A$=sectional area of pin, in square inches.
$D$=depth from edge of pinhole to end of leg in inches.
$2T$=thickness of two angles, in inches.

(d) Minimum diameter of rivets shall be found as follows:

Minimum diameter=

$$\sqrt{\frac{\text{load}}{0.7854\times 12{,}000\times N}} \qquad (5)$$

where:

$N$=number of rivets. Rivets shall be staggered in each leaf.

(e) The sectional area of gusset stays, when constructed of triangular right-handed web plates secured to single or double angle bars along the two sides at right angles, shall be determined by formula for diagonal stays, and shall be not less than 10 percent greater than would be necessary for a diagonal bolt stay.

(f) The diameter of a screw stay shall be taken at the bottom of the thread, provided it is the least diameter of the stay.

(g) For all stays the least sectional area shall be taken in calculating the stress allowable.

(h) The sectional area of pins to resist double shear and bending, accurately fitted and secured in crowfeet, sling, and similar stays, shall be at least equal to eight-tenths of the required sectional area of the brace. Breadth across each side and depth to crown of eye shall be not less than 0.35 of diameter of pin. In order to compensate for inaccurate distribution the forks shall be proportioned to support two-thirds of the load, thickness of forks to be not less than 0.66 of the diameter of pin.

(i) The combined sectional area of rivets used in securing tee irons and crowfeet to shell, said rivets being in tension, shall be not less than the required sectional area of brace. To insure a well-proportioned rivet point, rivets shall be of sufficient length to completely fill the rivet holes and form a head equal in strength to the body of the rivet. All rivet holes shall be drilled. Distance from center of rivet hole to edge of tee irons, crowfeet, and similar fastenings shall be so proportioned that the net sectional areas through sides at rivet holes shall equal the required rivet section. Rivet holes shall be slightly countersunk in order to form a fillet at point and head.

**§ 67.25–15 Stayed surfaces.**

(a) All stayed surfaces formed to a curve the radius of which is over 21 inches, excepting surfaces otherwise provided for, shall be deemed flat surfaces.

(b) (1) The maximum allowable pressure on flat plates supported by stays shall be determined by the following formula:

$$P=\frac{C\times T^2}{p^2} \qquad (1)$$

(2) When pitches of stays are unequal, $\frac{A^2+B^2}{2}$ is to be taken instead of $p^2$.

where:

$P$=maximum allowable pressure, in pounds per square inch.
$p$=pitch of stays when equal space in both directions, in inches.
$B$=distance between two rows of stays, in inches.
$T$=thickness of plates in sixteenths of an inch.
$C$=112 for screw stays with riveted heads, plates 7/16 inch thick and under.
$C$=120 for screw stays with riveted heads, plates above 7/16 inch thick.
$C$=120 for screw stays with nuts, plates 7/16 inch thick and under.
$C$=125 for screw stays with nuts, plates 7/16 inch thick and under 9/16 inch.
$C$=135 for screw stays with nuts, plates, 9/16 inch thick and above.
$C$=160 for stays with washers or doubling strips which have a thickness of at least 0.5 of the thickness of the plate and a diameter of at least 0.5 of the greatest pitch of the stay, riveted to the outside of the plates, and stays having one nut inside of the plate and one nut outside of the washer or doubling strip. For $T$ take 72 percent of the combined thickness of the plate and washer or plate and doubling strip.
$C$=175 for stays with double nuts, having one nut on the inside and one nut on the outside of the plate, without washers or doubling plates.
$C$=200 for stays fitted with doubling plates which have a thickness equal to at least 0.5 of the thickness of the plate reinforced, and covering the full area braced (up to the curvature of the flange, if any), riveted to either the inside or outside of the plate, and stays having one nut outside and one inside of the plates. Washers or doubling plates to be substantially riveted. For $T$ take 72 percent of the combined thickness of the two plates.
$C$=200 for stays with plates stiffened with tees or angle bars having a thickness of at least two-thirds the thickness of plate and depth of webs at least one-fourth of the greatest pitch of the stays, and substantially riveted on the inside of the plates, and stays having one nut inside bearing on washers fitted to the edges of the webs that are at right angles to the plate. For $T$ take 72 percent of the combined thickness of web and plate.

## Subpart 67.30—Combustion Chambers and Tube Sheets of Fire-Tube Boilers

**§ 67.30–1 Definitions.**

(a) *Combustion chamber.* Combustion chamber, within the meaning of this section, is that part of an internally-fired boiler in which combustible gases may be burned after leaving the furnace.

(b) *Separate combustion chamber.* Separate combustion chamber is a combustion chamber which is connected to one furnace only.

(c) *Common combustion chamber.* Common combustion chamber is a combustion chamber connected to two or more furnaces in a boiler.

(d) *Crown or top plate.* Crown or top plate is the top of a combustion chamber and is usually supported by girder stays or by sling stays or braces.

(e) *Wrapper sheet.* Wrapper sheet is the side plate of any type of combustion chamber and also the bottom plate of a common combustion chamber.

(f) *Curved bottom plate.* Curved bottom plate is the bottom of a separate combustion chamber formed to an arc of a circle and usually designed to be self-supporting.

(g) *Combustion chamber tube sheet.* Combustion chamber tube sheet is the plate, forming the end of a combustion chamber in which the tubes are secured.

(h) *Combustion chamber back sheet.* Combustion chamber back sheet is the plate opposite the tube sheet forming the back of the combustion chamber. It is usually stayed to the back head of the boiler by means of screw stays, or, in the case of double-ended boilers, to the back of the combustion chamber of the other end of the boiler.

(i) *Structural stiffeners.* Structural stiffeners are rolled shapes or flanged plates which are used to stiffen a surface which is not entirely self-supporting.

**§ 67.30–5 Materials.**

All plates forming parts of combustion chambers of fireboxes shall conform to the general specifications for the shell plates.

**§ 67.30–10 Computations.**

(a) *Curved bottom plate with reinforcement.* (1) Where rounded bottoms of combustion chambers are stiffened with single angle-iron stiffeners, such angles shall have a thickness of leaf eight-tenths that of the plate and a depth of at least one-half pitch. Where stiffened with double angle irons or tee bars, such angles or tee bars shall have a thickness of leaf at least two-thirds that of plate and a depth of at least one-fourth of pitch. Said angles or tee bars shall be substantially riveted to the plate supported. Where the bottom of combustion chambers are strengthened by angles or tee irons, the same shall be on the water side of the combustion chambers, as shown in in the sketches in this section.

(2) Where rounded tops of combustion chambers are stiffened with single or double angle-iron stiffeners or tee bars, such angles or tee bars shall be of thickness and depth of leaf not less than specified for rounded bottoms of combustion chambers. Said angles or tee bars shall be supported on thimbles and riveted through with rivets not less than 1 inch in diameter and spaced not to exceed 6 inches between centers.

(3) Maximum allowable pressure on rounded surfaces supported by angle-irons or tee bars shall be determined by the following formula:

$$P=\frac{900\times T^2}{p\times D} \qquad (1)$$

where:

$P$=maximum allowable pressure, in pounds per square inch.
$T$=thickness of plate in sixteenths of an inch.
$p$=pitch of angle or tee stiffeners, in inches.
$D$=diameter of curve to which plate is bent, in inches.

(b) *Curved bottom plate without reinforcement.* The maximum allowable pressure and the minimum thickness of round bottom of combustion chambers, angles being omitted, shall be computed by the following formulas:

$$P=\frac{50(300T-2L)}{D} \qquad (2)$$

$$T=\frac{P\times D+100L}{15{,}000} \qquad (3)$$

where:

$P$=maximum allowable pressure, in pounds per square inch.
$T$=thickness of bottom plate of combustion chamber, in inches.
$L$=extreme length of plate forming bottom of combustion chamber, in inches.
$D$=twice outside radius of bottom of combustion chamber, in inches.

(c) *Tube sheets.* (1) Maximum allowable pressure on tube sheets where combustion chambers are not suspended from the shell of the boiler shall be determined by the following formula:

$$P=\frac{(D-d)\,T\times 27{,}000}{W\times D} \qquad (4)$$

where:

$P$=maximum allowable pressure, in pounds per square inches.
$D$=least horizontal distance between tube centers, in inches.
$d$=inside diameter of tubes, in inches.
$T$=thickness of tube plate, in inches.
$W$=extreme width of combustion chamber, in inches.

(2) The compressive stress on tube plates, as determined by the following formula, shall not exceed 13,500 pounds per square inch, when pressure on top of combustion chamber is supported by vertical plates of such chamber.

$$S=\frac{P\times D\times W}{2(D-d)\,T} \qquad (5)$$

where:

$S$=compressive stress on tube sheet, in pounds per square inch.
$P$=maximum allowable pressure, in pounds per square inch.
$D$=least horizontal distance between tube centers, in inches.
$d$=inside diameter of tube, in inches.
$W$=extreme width of combustion chamber, in inches.
T=thickness of tube sheet, in inches.

(d) *Girders or crown bars.* (1) The maximum allowable pressure for girders or crown bars supporting the tops of

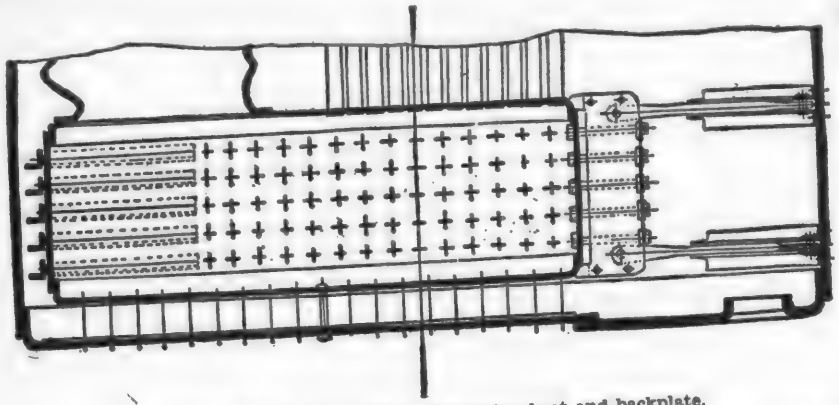

FIGURE 67.30-10 (d1)—Full load on tube sheet and backplate.

Diameter of hangers should be sufficient to carry the weight of combustion chamber and one-half the tubes and furnaces when no water is in boiler. No effect of buoyancy is considered.

These remarks are for separate combustion chambers when they are not secured to the shell at the bottom and therefore liable to bend the small screw stays.

In this case the tube sheet and backplate get the full compressive load in a similar manner to a boiler without hanging stays.

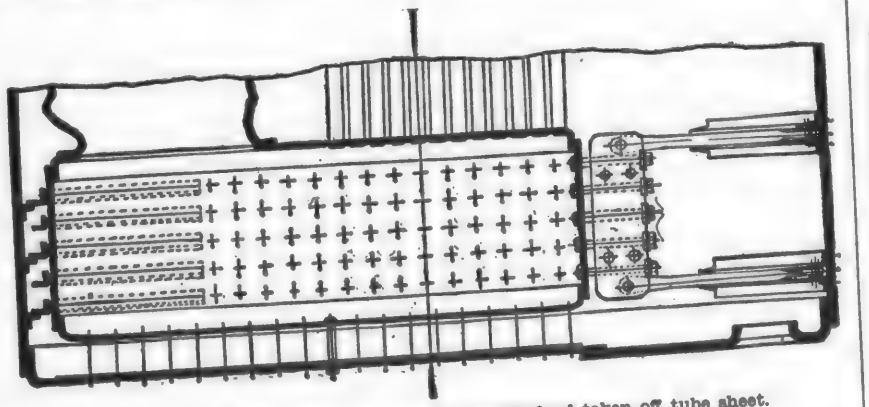

FIGURE 67.30-10 (d2)—Nearly whole compressive load taken off tube sheet.

Top hanging stays take full compressive load off tube sheet and backplate, except that half the load on unsupported portions marked B beyond stays will be taken by the tube sheet and backplate, respectively, and the other half by the last stays.

The thickness of tube sheet and backplate may be materially reduced from what would be required when tube sheet and backplate take full compressive load, providing that combustion chamber is well stayed to take full load at the bottom by screw stays or girders of plates and angles.

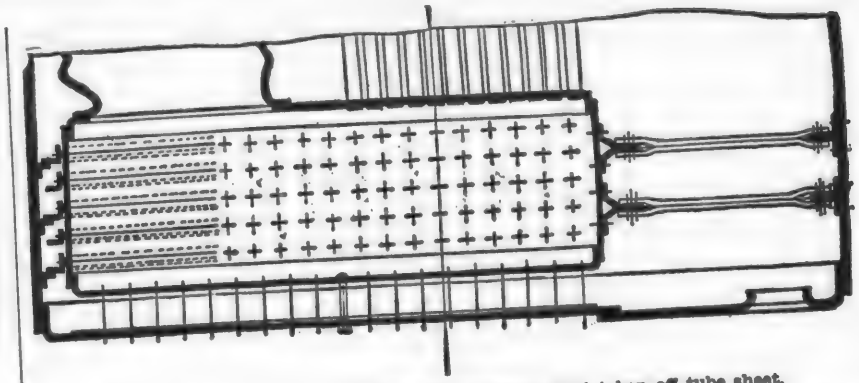

FIGURE 67.30-10 (d3)—Nearly whole compressive load taken off tube sheet.

Top hanging stays take full compressive load off tube sheet and backplate, except that half the load on unsupported portions marked B beyond stays will be taken by the tube sheet and backplate, respectively, and the other half by the last stays.

The bottom stays, whether of screw stays or girders of plates and angles, must be of the same sectional area as the top braces, and no boiler should be built having top stays as shown without having the bottom stays of equal strength.

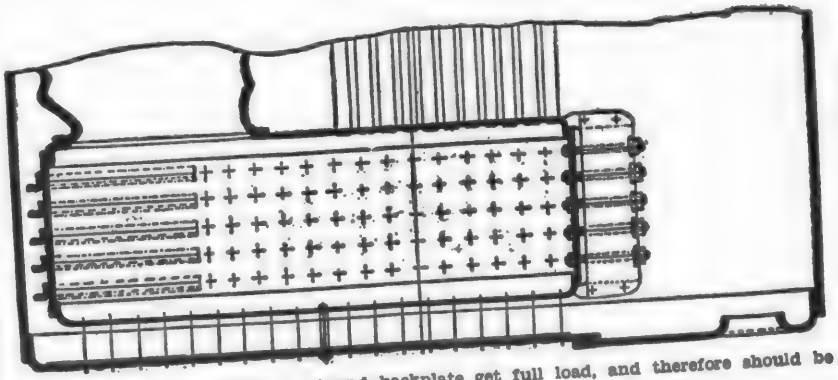

FIGURE 67.30-10 (d4)—Tube sheet and backplate get full load, and therefore should be heavy enough to withstand such.





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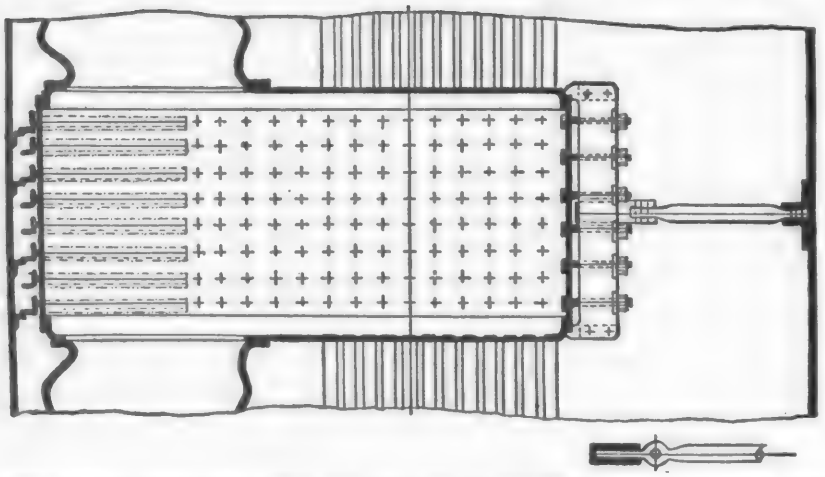

FIGURE 67.30-10 (d5)—Tube sheets each take part of compressive load, the hanging stays taking care of the other part.

The bottom stays, whether of screw stays or girders of plates and angles, must be of the same sectional area as the top braces.

In this case the thickness of the tube sheets may be materially reduced from what would be required when tube sheets together take full compressive load.

combustion chambers shall be determined by the following formula:

$$P=\frac{C\times d^2\times T}{(W-p)\times D\times L} \qquad (6)$$

where:

$P$=maximum allowable pressure, in pounds per square inch.
$W$=extreme width of combustion box, in inches.
$p$=pitch of supporting bolts, in inches.
$D$=distance between girders from center to center, in inches.
$L$=length of girder in feet between supports.
$d$=depth of girder, in inches.
$T$=thickness of girder, in inches.
$C$=550 when the girder is fitted with 1 supporting bolt.
$C$=825 when the girder is fitted with 2 or 3 supporting bolts.
$C$=917 when the girder is fitted with 4 or 5 supporting bolts.
$C$=963 when the girder is fitted with 6 or 7 supporting bolts.
$C$=990 when the girder is fitted with 8 or more supporting bolts.

(2) Sling stays may be used in lieu of girders in all cases: *Provided, however,* That when such sling stays are used, girders or screw stays of the same sectional area shall be used for securing the bottom of combustion chamber to the boiler shell.

(3) When girders are dispensed with and the top and bottom of combustion chambers are secured by sling stays or braces, the sectional area of such stays shall conform with the requirements of § 67.25–10.

(4) The following drawings show an excellent practice of constructing combustion chambers with and without sling stays.

## Subpart 67.35—Furnaces and Flues

### § 67.35–1 Definitions.

(a) *Furnace.* Furnace, within the meaning of this subpart, is a firebox or a large flue in which the fuel is burned.

(b) *Corrugated furnace.* Corrugated furnace is a cylindrical shell wherein corrugations are formed circumferentially for additional strength and to provide for expansion. (See Figures 67.35–1 (b1), 67.35–1 (b2), 67.35–1 (b3), 67.35–1 (b4), 67.35–1 (b5).)

(c) *Purves ribbed furnace.* Purves ribbed furnace is a cylindrical shell in which ribs or projections are formed circumferentially to provide additional strength. (See Figure 67.35–1 (c).)

(d) *Adamson ring furnace.* Adamson ring furnace is a cylindrical shell made in short sections, the ends of the sections being flanged and riveted together through a reinforcing ring. (See Figure 67.35–1 (d).)

(e) *Plain furnace.* Plain furnace is a cylindrical shell usually made in sections united by means of riveted joints. (See Figure 67.35–1 (e).)

(f) *Flues.* Flues are cylindrical shells made of seamless or welded tubing, or with a riveted longitudinal joint, the ends being attached by rivets. Their purpose is to provide additional heating surface and to form a path for the products of combustion. (See Figure 67.35–1 (e).)

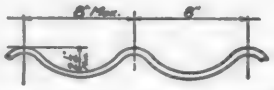

FIGURE 67.35–1 (b1)—Leeds suspension bulb furnace.

FIGURE 67.35–1 (b2)—Morison furnace.

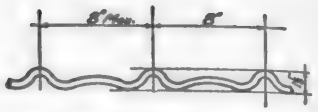

FIGURE 67.35–1 (b3)—Deighton furnace.

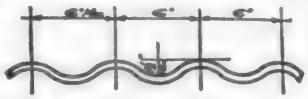

FIGURE 67.35–1 (b4)—Fox furnace.

FIGURE 67.35–1 (b5)—Brown furnace.

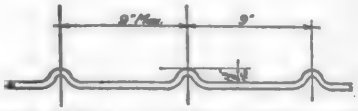

FIGURE 67.35–1 (c)—Purves ribbed furnace.

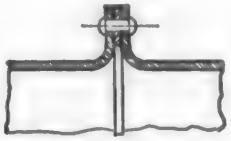

FIGURE 67.35–1 (d)—Adamson ring furnace.

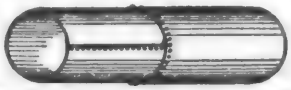

FIGURE 67.35–1 (e)—Circular riveted flue.

### § 67.35–5 Materials.

(a) All furnaces and flues shall be constructed of steel plates conforming to the requirements of Subpart 66.10 of this subchapter.

(b) The tensile strength of steel used in the construction of corrugated or ribbed furnaces shall not exceed 67,000 p. s. i. and be not less than 54,000 p. s. i.; and in all other furnaces the minimum tensile strength shall not be less than 58,000 p. s. i. and the maximum not more than 67,000 p. s. i. The minimum elongation in 8 inches shall be 20 percent.

### § 67.35–10 Computations.

(a) *Corrugated or ribbed furnaces.* All corrugated furnaces having plain parts at the ends not exceeding 9 inches in length (except flues especially provided for), when new, and made to practically true circles, shall be allowed a maximum pressure in accordance with the following formula:

$$P=\frac{C\times T}{D} \qquad (1)$$

where:

$P$=maximum allowable pressure in pounds per square inch.
$T$=thickness in inches, not less than five-sixteenths of an inch.
$D$=mean diameter, in inches.
$C$=Constant, as follows:

$C$=17,300, determined from an actual destructive test under the supervision of the Commandant, when corrugations are not more than 8 inches from center to center and not less than 2¼ inches deep, for Leeds Suspension bulb furnace.

$C$=determined from an actual destructive test under the supervision of the Commandant, when corrugations are not more than 8 inches from center to center and the radius of the outer corrugations is not more than one half of the suspension curve, for Morison furnace. [In calculating the mean diameter of the Morison furnace, the least inside diameter plus 2 inches may be taken as the mean diameter.]

$C$=15,600 when corrugations are not more than 8 inches from center to center and not less than 1½ inches deep, for Deighton furnace.

$C$=14,000, when corrugations are not more than 8 inches from center to center and not less than 1½ inches deep, for Fox furnace.

$C$=14,000, when rib projections are not more than 9 inches from center to center and not less than 1⅜ inches deep, for Purves furnace. [In calculating the allowable pressure for a Purves furnace, the thickness shall be not less than seven-sixteenths, and $D$ shall be taken as the least outside diameter.]

$C$=14,000, determined from an actual destructive test under the supervision of the Commandant, when corrugations are not more than 9 inches from center to center and not less than 1⅝ inches deep, from Brown furnace. [In calculating the allowable pressure for Brown furnace $D$ shall be taken as the least outside diameter.]

(b) *Corrugated furnaces having sections 18 inches long.* When furnaces are corrugated by sections not more than 18 inches from center to center, the maximum allowable pressure shall be in accordance with the following formula:

$$P=\frac{C \times T}{D} \quad (2)$$

where:

$P$=maximum allowable pressure, in pounds per square inch.

$T$=thickness in inches, not less than seven-sixteenths.

$D$=mean diameter, in inches.

$C$=10,000, a constant, when corrugated by sections not more than 18 inches from center to center and not less than 2½ inches deep, measuring from the least inside to the greatest outside diameter of the corrugations and having the ends fitted one into the other and substantially riveted together: *Provided*, That the plain parts at the ends do not exceed 12 inches in length.

(c) *Adamson furnace.* The maximum allowable pressure for Adamson furnaces made in sections of not less than 18 inches in length shall be determined by the following formula:

$$P=\frac{57.6}{D}[(18.75\times T)-1.03\times L)] \quad (3)$$

where:

$P$=maximum allowable pressure, in pounds per square inch.

$D$=outside diameter of furnace, in inches.

$L$=length of section, in inches.

$T$=thickness of plate, in sixteenths of an inch.

(d) *Spherical-top furnaces.* The minimum thickness and maximum allowable pressure of furnaces of 20 inches in diameter and over, when tops are portions of spheres and made in one plate, shall be determined by the following formula:

$$T=\frac{P\times R}{10,000}+0.12 \quad (4)$$

$$P=\frac{(T-0.12)\times 10,000}{R} \quad (5)$$

where:

$P$=maximum allowable pressure, in pounds per square inch.

$T$=thickness of plate when constructed of one plate, in inches.

$R$=radius of curvature, in inches.

$E$=efficiency riveted joint when end of furnace is constructed of more than one plate, the thickness will be $T/E$.

(e) *Plain circular riveted flues, furnaces, and cone tops.* (1) The maximum allowable pressure of cylindrical riveted flues and furnaces made in sections of not less than 18 inches in length fitted one into the other and substantially riveted, combustion chambers for vertical submerged tubular boilers in the shape of a frustum of a cone, constructed to a practically true circle, shall be the following formula:

$$P=\frac{51.5}{D}[(18.75\times T)-(1.03\times L)] \quad (6)$$

where:

$P$=maximum allowable pressure, in pounds per square inch.

$D$=outside diameter of furnaces, or outside mean diameter of cone top, in inches.

$L$=length of section or flue, in inches.

$T$=thickness of furnace or cone top, in sixteenths of an inch, not to be less than five-sixteenths of an inch.

(2) When diameter of plain furnaces and flues used in vertical type of boilers or mean diameter of cone tops exceed 42 inches, they shall be deemed a flat surface and must be stayed in accordance with rules governing flat surfaces. If a greater working pressure than given by formula is desired for mean diameters under 42 inches, the flues or cone tops shall be substantially stayed for such additional pressure.

(f) *Plain, lapwelded steel flues, 7 to 18 inches in diameter.* (1) Maximum allowable pressures and corresponding minimum thickness of wall for long, plain, lapwelded and seamless steel flues 7 to 18 inches diameter, subjected to external pressure only, shall be determined by the Table 67.35–10 (f) and formula (7).

TABLE 67.35–10 (f)

| Outside diameter of flue | Maximum allowable pressure, in pounds per square inch | | | | | | |
|---|---|---|---|---|---|---|---|
| | 100 | 120 | 140 | 160 | 180 | 200 | 220 |
| | Thickness of flue in inches. Safety factor, 5 | | | | | | |
| Inches: | | | | | | | |
| 7 | 0.152 | 0.160 | 0.168 | 0.177 | 0.185 | 0.193 | 0.201 |
| 8 | .174 | .183 | .193 | .202 | .212 | .220 | .229 |
| 9 | .196 | .206 | .217 | .227 | .237 | .248 | .258 |
| 10 | .218 | .229 | .241 | .252 | .264 | .275 | .287 |
| 11 | .239 | .252 | .265 | .277 | .290 | .303 | .316 |
| 12 | .261 | .275 | .289 | .303 | .317 | .330 | .344 |
| 13 | .283 | .298 | .313 | .328 | .343 | .358 | .373 |
| 14 | .301 | .320 | .337 | .353 | .369 | .385 | .402 |
| 15 | .323 | .343 | .361 | .378 | .396 | .413 | .430 |
| 16 | .344 | .366 | .385 | .404 | .422 | .440 | .459 |
| 17 | .366 | .389 | .409 | .429 | .448 | .468 | .488 |
| 18 | .387 | .412 | .433 | .454 | .475 | .496 | .516 |

(2) Thickness in Table 67.35–10 (f) were calculated by formula:

$$T=\frac{[(F\times P)+1,386]\ D}{86,670} \quad (7)$$

where:

$D$=outside diameter of flue, in inches.

$T$=thickness of wall, in inches.

$P$=maximum allowable pressure, in pounds per square inch.

$F$=factor of safety.

(3) This formula (7) is applicable to lengths greater than six diameters of flue, to pressures greater than 100 pounds, to outside diameters of from 7 to 18 inches, and to temperatures less than 650° F.

(4) The maximum allowable pressure shall be determined by the following formula:

$$P=\frac{(T\times 86,670)-(1,386\times D)}{D\times F} \quad (8)$$

where:

$P$=maximum allowable pressure, in pounds per square inch.

$D$=outside diameter of flue, in inches.

$T$=thickness of wall, in inches.

$F$=factor of safety.

(g) *Riveted flues over 6 and not over 18 inches in diameter, made in sections, and subjected to external pressure only.* The maximum allowable pressure on riveted flues constructed of plates made in sections, not less than 24 inches in length, over 6 and not exceeding 18 inches in diameter, shall be determined by the following formula:

$$P=\frac{8,100\times T}{D} \quad (9)$$

where:

P=maximum allowable pressure, in in pounds per square inch.

$T$=thickness in inches, minimum thickness not less than 0.25 inch.

$D$=outside diameter, in inches.

(h) *Riveted, seamless, or lapwelded flues over 18 and not over 28 inches in diameter, made in sections, and subjected to external pressure only.* The maximum allowable pressure on riveted, seamless, or lapwelded flues over 18 inches in diameter up to and including 28 inches in diameter, made in sections not less than 24 inches in length, effi-

ciently riveted together, sections not to exceed 3½ times the diameter of the flue, when subjected to external pressure only, shall be determined by the following formula:

$$P=\frac{51.5}{D}[(18.75\times T)-(L\times 1.03)] \quad (6)$$

where:

$P$=maximum allowable pressure, in pounds per square inch.
$D$=outside diameter of flue, in inches.
$L$=length of flue in inches, not to exceed 3½ diameters of flue.
$T$=thickness of wall, in sixteenths of an inch.

(i) *Steam chimneys.* (1) When steam chimneys constructed of flues subject to external pressure have a thickness of not less than seven-sixteenths of an inch, and the flue is heated only with the waste gases, and the temperature does not exceed 600 degrees F., the maximum allowable pressure shall be determined by the rules for plain furnaces or flues, corrugated furnaces, and Adamson type.

(2) When flues are strengthened with tee irons, angle irons, or bowling rings the pressure shall be determined by formula for plain furnace flues. When angle or tee bars are used they shall have a thickness of leaf of at least two-thirds that of plate and a depth of at least one-fourth of pitch. Said tee bars shall be substantially riveted to flue. All rivet holes in tees shall be drilled, holes shall be staggered, distance from center of rivet holes to edge of tees shall be not less than 1.5 times diameter of rivet holes, and percentage of plate section shall be not less than rivet section. Bowling rings may be used, as they increase the strength and provide for expansion of flue. For all boilers carrying a steam pressure of over 60 pounds and not over 100 pounds per square inch the flue may be braced with socket bolts in lieu of tee rings. Such bolts shall have heads and the ends shall be threaded for nuts, with plate washers or equivalent on the inside of flue. Pitch of stays and bolts and the maximum stress in pounds allowable per square inch of cross-sectional area for stays and bolts shall be determined by Subpart 67.25.

(3) If a greater allowable stress is desired on flues than that permitted by the formula for flues strengthened with bowling rings or tee irons, the flue may be braced to shell and may be deemed a flat surface, and shall be stayed in strict accordance with the rules for stays.

### § 67.35–15 Detail requirements.

(a) The thickness of corrugated and ribbed furnaces shall be ascertained by actual measurement. The manufacturer shall have said furnaces drilled for a three-eighths inch pipe tap and fitted with a screw plug that can be removed by the inspector when taking this measurement. For the Brown and Purves furnaces the holes shall be in the center of the second flat; for the Morison, Fox, and other similar types, in the center of the top corrugation, at least as far in as the fourth corrugation from the end of the furnace.

(b) (1) When plain horizontal flues are made in sections not less than 18 inches in length, and not less than five-sixteenths of an inch thick, and flanged to a depth of not less than three times the diameter of rivet holes plus the radius at furnace wall (inside diameter of furnace), the thickness of the flanges shall be as near the thickness of the body of the plate as practicable.

(2) The radii of the flanges on the fire side shall be not less than three times the thickness of plate. The distance from the edge of the rivet hole to the edge of the flange shall be not less than the diameter of the rivet hole, and the diameter of the rivets before driven shall be at least one-fourth inch larger than the thickness of the plate.

(3) The depth of the ring between the flanges shall be not less than three times the diameter of the rivet holes, and the ring shall be substantially riveted to the flanges. The fire edge of the ring shall terminate at or about the point of tangency to the curve of the flange, and the thickness of the ring shall be not less than one-half inch.

(c) When lapwelded or seamless flues over 5 inches in diameter are used in externally fired boilers over 20 feet in length, they may be allowed to be made in two pieces joined together by (1) a standard screwpipe coupling or sleeve, or by (2) swelling the end of one section of the flue sufficiently to permit it to lap over the other section not less than 4 inches and be double riveted, or by (3) butting the two sections of the flue together and fitting a band or butt strap not less than 8 inches in length equally divided over the joint of the two sections, and of a thickness of the flue, and double riveted to each section. When any of the above methods are used on more than one flue in a boiler, the couplings or sleeves shall not be allowed to come opposite, and the distance measured between any such flues and between any such flues and the shell shall be made by measuring between the plates in the flues and the plates in the shell. It shall be the duty of the inspectors to see that the flues are well screwed into the couplings or sleeves, so as to have the ends of flues as near together as is practicable.

(d) Drainpipes shall be fitted to steam chimneys in which water is liable to collect. Steam chimneys that are arranged to be disconnected from main boiler shall be provided with a safety valve not less than 3 inches in diameter and with a steam gage, and shall be provided with manholes to enable inspectors to examine every portion of the interior.

## Subpart 67.40—Boiler and Superheater Tubes

### § 67.40–1 Definitions.

(a) *Tubes.* Tubes, within the meaning of this subpart, are cylindrical shells of comparatively small diameter constituting the main part of the heating surface of a boiler or superheater.

(b) *Safe end.* Safe end is a short piece of boiler tube which is usually thicker than the ordinary tube and is welded to a tube of lighter gauge for the purpose of lengthening it.

(c) *Seamless tube.* Seamless tube is a tube without any longitudinal joint.

(d) *Lap-welded tube.* Lap-welded tube made with a longitudinal rolled or hammered lap-welded joint.

(e) *Stay tube.* Stay tube is a thick-walled tube, the end of which is usually thickened by upsetting to compensate for threading. Such tubes are used for staying tube sheets into which they are screwed and expanded.

(f) *Expanding.* Expanding is the process of enlarging the end of a tube to make it fit tightly in the tube sheet.

(g) *Beading.* Beading is the process of turning over the protruding end of a tube after expanding to form a supporting collar for the tube sheet.

(h) *Bell-mouthing.* Bell-mouthing is the process of flaring the end of a tube beyond where it is expanded in the tube sheet.

### § 67.40–5 Materials and workmanship.

(a) Seamless steel boiler tubes shall comply with the requirements of Subpart 66.25 of this subchapter.

(b) Lap-welded steel and wrought-iron boiler tubes shall comply with the requirements of Subpart 66.20 of this subchapter for such tubes.

(c) Seamless copper or brass tubes not exceeding three-fourths of an inch in diameter may be used in the construction of water-tube boilers or generators when liquid fuel is used.

### § 67.40–10 Computations.

(a) *Lapwelded and seamless tubes.* Lapwelded and seamless tubes used in boilers whose construction was commenced after June 30, 1910, and having a thickness of material according to their respective diameters, shall be allowed a maximum pressure as prescribed in Table 67.40–10 (a), provided they are deemed safe by the inspectors.

TABLE 67.40–10 (a)

| Outside diameter (inches) | Thickness of material, inches | Maximum pressure allowed, p. s. i. | Outside diameter (inches) | Thickness of material, inches | Maximum pressure allowed, p. s. i. |
|---|---|---|---|---|---|
| 2 | 0.095 | 427 | 3½ | 0.120 | [illegible] |
| 2¼ | .095 | [illegible] | 3¾ | .120 | [illegible] |
| 2½ | .109 | 392 | 4 | .134 | 303 |
| 2¾ | .109 | 356 | 4½ | .134 | 238 |
| 3 | .109 | [illegible] | 5 | .148 | [illegible] |
| 3¼ | .120 | [illegible] | 6 | .165 | [illegible] |

(b) Where heavier material is used a maximum pressure may be allowed as prescribed in § 67.35–10 (f), for determining the pressure of plain, lap-welded steel flues, 7 to 18 inches in diameter.

(c) Any length of tube is allowable.

### § 67.40–15 Safe-ending.

No tube increased in thickness by welding one tube inside of another shall be allowed for use, but the ends of boiler tubes may be welded on for the purpose of making repairs or new tubes may be welded for the purpose of making them longer: *Provided,* That such welding is not made by any process of autogenous welding.

## Subpart 67.45—Safety Valves

### § 67.45–1 Definitions.

(a) *Safety valve.* Safety valve is a valve designed to open automatically to relieve excess pressure in the boiler or pressure vessel to which it is attached.

(b) *Spring loaded safety valve.* Spring loaded safety valve is a safety valve fitted with a spring to hold the valve against its seat and allows it to open at a given pressure. This term applies to pop safety valves of various forms.

(c) *Lever safety valve.* Lever safety valve is a safety valve having the disk held on its seat by the action of a weight hung on a lever which is pivoted on a fulcrum.

(d) *Relief valve.* Relief valve is a valve constructed on the general design of safety valves to relieve excess pressure. It may be used for service where an approved safety valve is not required by the regulations of this subchapter.

### § 67.45–5 General requirements.

(a) After June 30, 1928, no type of safety valve shall be used on any vessel coming under the jurisdiction of this service that has not been approved by the Commandant.

(b) The manufacturers of safety valves shall file an affidavit with the Commandant that the safety valves manufactured by them will be in all respects in accordance with the blueprints and specifications on file in the office of the Commandant, and shall permanently attach a name plate to the valves that shall show the name of the manufacturer, the pressure the casing is guaranteed to stand, diameter, seat area, serial number, and capacity.

(c) The valves shall be so arranged that each boiler shall have at least one separate safety valve, unless the arrangement is such as to preclude the possibility of shutting off the communication of any boiler with the safety valve or valves employed. This arrangement shall also apply to lockup safety valves when they are employed.

(d) The use of two safety valves may be allowed on any boiler, provided the combined area of such valves is equal to that required by rule for one such valve. Whenever the area of a safety valve, as found by the regulations in this subpart, is greater than that corresponding to 4½ inches in diameter, two or more safety valves, the combined area of which shall be equal at least to the area required, shall be used.

(e) Before any safety valve is put into service it shall be subjected to a pressure of one and one-half times the pressure it is to be subjected to when in actual service.

(f) Safety valves when fitted either to the shell of boiler or steam drum may be fitted with internal dry pipes when made of standard steam pipe or of riveted material equal in thickness, and when the combined openings in the dry pipe equal in area at least one and one-half times the opening of the valve.

(g) Where escape pipes for safety valves are installed after July 1, 1926, the area of the escape pipes shall be at least equal to the area of the outlet furnished with the safety valve, and in no case shall the area be less than the area of inlet. The fitting shall be as short and straight as possible, and so arranged as to avoid undue stress upon the valve. Where the escape pipe is used for two or more safety valves, the area of the escape pipe shall equal the combined areas of all the safety valves.

(h) Hereafter no safety valves having a set-screw arrangement on top of the valve casing, designed to hold the valve down while the hydrostatic pressure is being applied, shall be allowed. On such valves now in use, inspectors shall require the set screws to be taken out and the hole permanently closed. This does not apply to any safety valve whose form of construction is such that the hole for the set screw or bolt is securely closed when the valve is locked.

### § 67.45–10 Detail requirements.

(a) (1) The areas of all safety valves on boilers contracted for or the construction of which commenced on or after June 1, 1904, shall be determined in accordance with the following formula and table:

$$a = 0.2074 \times \frac{W}{P} \qquad (1)$$

where:

$a$ = area of safety valve, per square foot of grate surface, in square inches.

$W$ = pounds of water evaporated per square foot of grate surface per hour.

$P$ = absolute pressure, in pounds per square inch = maximum allowable gage pressure 15.

(2) The areas required per square foot of grate surface in the Table 67.45–10 (a) have been computed from the formula by assuming the different valves of $W$ and $P$.

(3) The areas ($a$) shown in Table 67.45–10 (a) multiplied by square feet of grate surface give the area of safety valve or valves required. When this calculation results in an off size of safety valve, use next larger standard size.

(b) The area of a safety valve for boilers using oil as fuel or for boilers designed for any evaporation per hour shall be computed by dividing the total number of pounds of water evaporated per hour by any number of pounds of water evaporated per square foot of grate surface per hour ($W$) taken from, and within the limits of Table 67.45–10 (a). This will give the equivalent number of square feet of grate surface for boiler for estimating the area of valve. Then apply the table for determining the area of the safety valve.

(c) Where safety valves are used with beveled seats, the seats shall have an angle of inclination of 45° to the center of their axes. Flat-seat safety valves may be used under the formula and table prescribed in this subpart. The discharge capacity of a flat-seat valve shall be 1.4 times that allowed for a bevel-seat valve.

### § 67.45–13 Lever safety valves.

(a) All common lever safety valves to be hereafter applied to the boilers of steam vessels shall be constructed in material, workmanship, and principle accordance to the requirements for a safety valve referred to in this section. When this construction of a safety valve is applied to the boilers of steamers navigating rough waters, the link may be connected direct with the spindle valve: *Provided, always,* That the fulcrum or points upon which the lever rests are made of steel, knife, or sharp-edged, and hardened; in this case the short end of the lever shall be attached directly to the valve casing. In all cases the link requires but a slight movement not exceeding ⅛ inch.

(b) All the points of bearing on lever shall be in the same place.

(c) The distance of the fulcrum shall in no case be less than the diameter of the valve opening.

(d) The length of the lever shall not exceed the distance of the fulcrum multiplied by ten.

(e) The width of the bearings of the fulcrum shall be not less than ¾ inch.

(f) The length of the fulcrum link shall be not less than 4 inches.

(g) The lever and fulcrum link shall be made of wrought-iron or steel and the knife-edged fulcrum points and bearings for the points shall be made of steel and hardened. But the chambers and saddle flanges of this and all other types of safety valves attached to boilers may be made of cast iron or other suitable material.

(h) The valve, valve seat, and bushing for the stem or spindle shall be made of composition (gun metal) when the valve is intended to be attached to a boiler using salt water; but when the valve is to be attached to a boiler using fresh water and generating steam of a high pressure the parts named, with the exception of the bushings for the spindle, may be made of cast iron.

(i) The valve shall be guided by its spindle, both above and below the ground seat and above the lever, through supports either made of composition (gun metal) or bushed with it. The spindle shall fit loosely in the bearings or supports.

(j) When the valve is intended to be applied to the boilers of steamers navigating rough waters, the fulcrum link may be connected directly with the spindle of the valve; providing always that the knife-edged fulcrum points are made of steel and hardened, and that the vertical movement of the valve is unobstructed by any lateral movement.

(k) In all cases the weight shall be adjusted on the lever to the pressure of steam allowed in each case by a correct steam gage attached to the boiler. The weight shall then be securely fastened in its position and the lever marked for the purpose of facilitating the replacing of the weight should it be necessary to remove the same, and in no case shall a line or any other device be attached to the lever or weight except in such a manner as will enable the engineer to raise the valve from its seat.

TABLE 67.45-10 (a)—AREA OF SAFETY VALVES REQUIRED PER SQUARE FOOT OF GRATE SURFACE FOR DIFFERENT PRESSURES AND RATES OF EVAPORATION

| P. absolute pressure, pounds per square inch | Gage pressure, pounds per square inch | These figures represent evaporation in pounds per square foot of grate surface per hour ($W$) = pounds water evaporated per pound coal × pounds coal burned per square foot of grate surface per hour | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 100 | 120 | 140 | 160 | 180 | 200 | 220 | 240 | 260 | 280 | 300 | 320 | 340 | 360 | 380 |
| | | The figures below give (a), the area in square inches required per square foot of grate surface at above rate of evaporation | | | | | | | | | | | | | | |
| 65 | 50 | 0.319 | 0.383 | 0.447 | 0.510 | 0.574 | 0.638 | 0.702 | 0.765 | 0.829 | 0.893 | 0.956 | | | | |
| 70 | 55 | .296 | .355 | .414 | .474 | .533 | .592 | .652 | .711 | .769 | .828 | .888 | | | | |
| 75 | 60 | .276 | .332 | .387 | .442 | .497 | .552 | .608 | .663 | .718 | .773 | .829 | | | | |
| 80 | 65 | .259 | .311 | .363 | .415 | .466 | .518 | .570 | .622 | .674 | .726 | .778 | | | | |
| 85 | 70 | .244 | .292 | .341 | .390 | .438 | .487 | .536 | .585 | .634 | .682 | .731 | | | | |
| 90 | 75 | .230 | .276 | .322 | .368 | .414 | .460 | .506 | .552 | .598 | .644 | .690 | | | | |
| 95 | 80 | .218 | .262 | .305 | .349 | .392 | .436 | .479 | .523 | .567 | .610 | .654 | | | | |
| 100 | 85 | .207 | .249 | .290 | .332 | .373 | .414 | .456 | .497 | .538 | .580 | .622 | | | | |
| 105 | 90 | .197 | .236 | .276 | .316 | .355 | .394 | .434 | .473 | .513 | .552 | .592 | | | | |
| 110 | 95 | .188 | .226 | .264 | .301 | .339 | .377 | .414 | .452 | .489 | .527 | .565 | | | | |
| 115 | 100 | .180 | .216 | .252 | .288 | .324 | .360 | .396 | .432 | .468 | .504 | .540 | | | | |
| 120 | 105 | .172 | .207 | .241 | .276 | .311 | .345 | .379 | .414 | .448 | .483 | .517 | | | | |
| 125 | 110 | .166 | .199 | .232 | .265 | .298 | .331 | .364 | .397 | .431 | .463 | .497 | | | | |
| 130 | 115 | .160 | .192 | .223 | .255 | .287 | .319 | .351 | .383 | .415 | .447 | .479 | | | | |
| 135 | 120 | .153 | .184 | .215 | .246 | .276 | .307 | .337 | .368 | .398 | .429 | .460 | | | | |
| 140 | 125 | .148 | .177 | .207 | .237 | .266 | .296 | .325 | .355 | .385 | .414 | .444 | | | | |
| 145 | 130 | .143 | .172 | .201 | .229 | .258 | .287 | .315 | .344 | .372 | .401 | .430 | | | | |
| 150 | 135 | .138 | .166 | .194 | .222 | .249 | .277 | .304 | .332 | .360 | .387 | .415 | | | | |
| 155 | 140 | .134 | .160 | .187 | .214 | .241 | .268 | .294 | .321 | .348 | .375 | .401 | | | | |
| 160 | 145 | .130 | .156 | .181 | .207 | .233 | .259 | .285 | .311 | .337 | .363 | .389 | | | | |
| 165 | 150 | .126 | .151 | .176 | .201 | .226 | .251 | .276 | .301 | .326 | .352 | .378 | | | | |
| 170 | 155 | .122 | .146 | .171 | .195 | .219 | .244 | .268 | .292 | .317 | .341 | .366 | | | | |
| 175 | 160 | .118 | .142 | .166 | .189 | .213 | .236 | .260 | .284 | .308 | .331 | .355 | | | | |
| 180 | 165 | .115 | .138 | .161 | .184 | .207 | .230 | .254 | .277 | .300 | .323 | .346 | | | | |
| 185 | 170 | .112 | .135 | .157 | .179 | .202 | .224 | .247 | .269 | .291 | .314 | .336 | | | | |
| 190 | 175 | .109 | .131 | .153 | .175 | .196 | .218 | .240 | .262 | .284 | .306 | .328 | | | | |
| 195 | 180 | .106 | .128 | .149 | .170 | .191 | .213 | .234 | .255 | .277 | .298 | .319 | | | | |
| 200 | 185 | .104 | .124 | .145 | .166 | .187 | .207 | .228 | .249 | .270 | .290 | .310 | | | | |
| 205 | 190 | .101 | .121 | .142 | .162 | .182 | .202 | .223 | .243 | .263 | .283 | .303 | | | | |
| 210 | 195 | .099 | .119 | .138 | .158 | .178 | .198 | .217 | .237 | .257 | .277 | .297 | | | | |
| 215 | 200 | .096 | .116 | .135 | .154 | .173 | .193 | .212 | .231 | .250 | .269 | .289 | 0.308 | 0.327 | 0.347 | 0.366 |
| 220 | 205 | .094 | .113 | .132 | .151 | .170 | .189 | .208 | .226 | .245 | .264 | .283 | .302 | .321 | .340 | .358 |
| 225 | 210 | .092 | .110 | .129 | .147 | .166 | .184 | .203 | .221 | .240 | .258 | .276 | .295 | .314 | .332 | .350 |
| 230 | 215 | .090 | .108 | .126 | .144 | .162 | .180 | .198 | .216 | .235 | .253 | .270 | .289 | .307 | .325 | .343 |
| 235 | 220 | .088 | .106 | .124 | .141 | .159 | .176 | .194 | .212 | .229 | .247 | .264 | .282 | .300 | .318 | .336 |
| 240 | 225 | .086 | .104 | .121 | .138 | .155 | .173 | .190 | .207 | .225 | .242 | .259 | .276 | .294 | .311 | .329 |
| 245 | 230 | .085 | .102 | .119 | .135 | .152 | .170 | .186 | .203 | .220 | .237 | .254 | .271 | .288 | .305 | .322 |
| 250 | 235 | .083 | .100 | .117 | .133 | .149 | .167 | .183 | .199 | .216 | .233 | .249 | .266 | .282 | .299 | .315 |
| 255 | 240 | .081 | .098 | .114 | .130 | .146 | .163 | .179 | .195 | .211 | .228 | .244 | .261 | .277 | .293 | .309 |
| 260 | 245 | .080 | .096 | .112 | .128 | .144 | .160 | .176 | .192 | .208 | .224 | .240 | .255 | .271 | .287 | .303 |
| 265 | 250 | .078 | .094 | .110 | .125 | .141 | .157 | .172 | .188 | .203 | .219 | .235 | .250 | .266 | .282 | .298 |
| 270 | 255 | .077 | .092 | .107 | .123 | .138 | .153 | .169 | .184 | .199 | .215 | .230 | .245 | .261 | .276 | .291 |
| 275 | 260 | .075 | .090 | .105 | .121 | .136 | .151 | .166 | .181 | .196 | .211 | .226 | .241 | .256 | .271 | .286 |
| 280 | 265 | .074 | .089 | .104 | .118 | .133 | .148 | .163 | .178 | .192 | .207 | .222 | .237 | .251 | .266 | .281 |
| 285 | 270 | .073 | .087 | .102 | .116 | .131 | .146 | .160 | .175 | .189 | .204 | .218 | .233 | .247 | .262 | .276 |
| 290 | 275 | .072 | .086 | .100 | .114 | .129 | .143 | .157 | .172 | .186 | .200 | .214 | .228 | .242 | .257 | .271 |
| 295 | 280 | .070 | .084 | .098 | .112 | .127 | .141 | .154 | .169 | .182 | .196 | .210 | .224 | .238 | .253 | .267 |
| 300 | 285 | .069 | .083 | .096 | .110 | .124 | .138 | .151 | .166 | .179 | .193 | .207 | .221 | .235 | .249 | .263 |
| 305 | 290 | .068 | .082 | .095 | .109 | .122 | .136 | .149 | .163 | .177 | .190 | .204 | .217 | .231 | .245 | .258 |
| 310 | 295 | .067 | .080 | .093 | .107 | .120 | .134 | .147 | .160 | .174 | .187 | .201 | .214 | .227 | .241 | .254 |
| 315 | 300 | .066 | .079 | .092 | .105 | .118 | .132 | .145 | .158 | .171 | .184 | .197 | .210 | .223 | .237 | .250 |

**§ 67.45-15 Spring-loaded safety valves.**

Any spring-loaded safety valve constructed so as to give an increase lift by the operation of steam after being raised from its seat, or any spring-loaded safety valve constructed in any other manner, so as to give an effective area equal to that of the afore-mentioned spring-loaded safety valve, may be used in lieu of the common lever-weighted valve on all boilers on steam vessels, and each spring-loaded valve shall be supplied with a lever that will raise the valve from its seat a distance of not less than that equal to one-eighth of the diameter of the valve opening; but in no case shall any spring-loaded safety valve be used in lieu of the lever-weighted safety valve without first having been approved by the Commandant.

## Subpart 67.50—Boiler Mountings and Attachments

**§ 67.50-1 Definitions.**

(a) *Mountings.* Mountings, within the meaning of this subchapter, are nozzle connections, distance pieces, valves, or fittings attached directly to the boiler.

(b) *Main stop valve.* Main stop valve is a valve usually connected directly to the boiler for the purpose of shutting off the steam from the main steam line.

(c) *Auxiliary stop valve.*—Auxiliary stop valve is a valve usually connected directly to the boiler for the purpose of shutting off the steam from the auxiliary lines (including the whistle lines).

(d) *Manifold.* Manifold is a fitting with two or more branches having valves either attached by bolting or integral with the fitting.

(e) *Feed valve.* Feed valve is a valve in the feed-water line which controls the boiler feed.

(f) *Blow-off valve.* Blow-off valve is a valve connected directly to the boiler for the purpose of blowing out water, scum, or sediment.

(g) *Dry pipe.* Dry pipe is a perforated or slotted pipe placed in the highest part of the steam space of a boiler to prevent priming.

(h) *Water column.* Water column is a fitting or tube equipped with a water glass attached to a boiler for the purpose of indicating the water level.

(i) *Test cocks.* Test cocks are small cocks on a boiler for indicating the water level.

(j) *Salinometer cocks.* Salinometer cocks are cocks attached to a boiler for the purpose of drawing off a sample of water for salinity tests.

(k) *Fusible plugs.* Fusible plugs are plugs made with a bronze casing and a tin filling which melts at a temperature of 450 degrees to 500 degrees F. They are intended to melt in the event of low water and thus warn the engineer on watch.

**§ 67.50-5 Detailed requirements.**

(a) Where the thickness of the material in the boiler or drum, or the heads thereof, is not less than ½ inch, or where such boiler, drum, or head thereof has been reinforced by having a pad or flange riveted on the same, to make the thickness not less than ½ inch, pipes or fittings of 2 inches in diameter or under may be screwed directly into the same. Where steam or feed pipes of 2 inches in diameter or under are screwed into the boiler, the stop valve shall be connected to the boiler by as short a nipple as it is possible to use, nipples to be of extra-heavy thickness.

(b) All boiler connections of over 2 inches in diameter, except the connections for safety valves, shall be permanently flanged and attached directly to the boiler by bolts, studs, or rivets.

(c) Where the connecting point on the boiler is of circular form, distance pieces shall be allowed in order to square the point of the flanged fittings.

(d) Flanged distance pieces of not more that 8 inches between flanges may be allowed between stopcocks or valves and the boiler when necessary to care for and conveniently handle the valves, when such distance pieces are constructed of wrought material of sufficient thickness and strength to withstand any pressure to which they may be subjected and securely riveted to the boiler.

(e) Cast-steel flanged fittings, when conforming strictly with the requirements for steel castings, may be used for the purpose of connecting main and auxiliary stop valves and other steam outlets, including safety valves, distance from axis of outlets of such fittings to point of connection with boiler to be as short as practicable.

(f) All valves and fittings over 2 inches diameter shall be flanged and properly secured at point of connection with boiler by bolts, studs, or rivets, and no fitting shall be of greater length than specified by the "Manufacturers' Standard."

(g) Cast nozzles shall not be used when exposed to the direct action of the fire.

(h) On all boilers built after July 1, 1896, a stopcock or value shall be placed between all check valves and boiler, and between all steam and water pipes and boiler. Valves of 2 inches diameter or less connected directly to the boiler shall be of cast steel, hard brass, or bronze.

(i) The use of malleable-iron or cast-steel manifolds, tees, return bends, or elbows in the construction of pipe generators shall be allowed, and the pressure of steam shall not be restricted to less than one-half the hydrostatic pressure applied to pipe generators unless a weakness should develop under such test as would render it unsafe in the judgment of the inspector making such inspection.

**§ 67.50–10 Superheaters.**

(a) The headers of superheaters may be made of semisteel (so-called) in which the constituent part of high-grade uniform steel thereof shall be not less than 25 percent and that the material shall have a tensile strength of not less than 28,000 pounds per square inch. The material shall be soft and close-grained and the castings shall be tight under a hydrostatic pressure of 850 pounds per square inch.

(b) When interdeck superheaters are used in connection with water-tube boilers of approved design, and the fittings and pipes between the drum of the boilers and the header of the superheaters are made of seamless steel and of a thickness in accordance with the rules to withstand any pressure sustained by any part of the boiler, such fittings connecting with pipes of steam drum or superheater shall be either steel forgings or steel castings. The stop valve may be attached to the discharge end of the superheater: *Provided,* That this section shall not apply to safety valves that have been approved by the Commandant.

**§ 67.50–15 Feed connections.**

Feed water shall not be admitted into any marine boiler at a temperature less than 100 degrees F., and every such boiler, excepting donkey boilers, shall after October 31, 1909, have an independent auxiliary feed appliance for supplying said boiler with water in addition to the usual mode employed, which auxiliary feed shall enter the boiler through an opening and a fitting which are entirely independent of the fitting and opening for the main feed.

**§ 67.50–20 Fusible plugs.**

(a) Fusible plugs for use in boilers of vessels inspected under this Subchapter shall be manufactured from acceptable heats in accordance with Subpart 162.014 of Subchapter Q (Specifications) of this chapter.

(b) Every boiler other than a boiler of the water-tube type shall be fitted with at least two fusible plugs located as follows:

(1) An upright boiler shall be fitted with two plugs of an external diameter of not less than ⅜ inch pipe tap. The plugs shall be located in separate tubes not more than 2 inches below the lowest gage cock.

(2) An externally heated cylindrical boiler, with flues, shall have one plug in the top of the upper flue, not more than 4 feet from the back end of the flue, and shall also have a plug fitted to the shell of the boiler immediately below the fire line, and not less than 4 feet from the front end: *Provided,* That when the flues are not more than 6 inches in diameter plugs of not less diameter than ⅜ inch pipe tap may be used in such flues.

(3) Fire-box, scotch, and any other type of shell boiler not specially provided for, having a combustion chamber common to all furnaces, shall have two plugs fitted to the crown sheet of the combustion chamber at or near the center of the crown sheet and not more than 12 inches apart.

(4) A double-end boiler with separate combustion chambers, each of which combustion chamber is common to all furnaces in its own end of the boiler, shall have two plugs fitted to the crown sheet of each combustion chamber at or near the center of the crown sheet, and not more than 12 inches apart.

(5) A boiler fitted with a separate combustion chamber for each individual furnace shall be fitted with a plug in the center of the crown sheet of each combustion chamber.

(6) A boiler of any type not herein provided for shall be fitted with at least two plugs of such dimensions and located in such parts of the boiler as will, in the judgment of the Officer in Charge, Marine Inspection, best meet the purposes for which they are intended.

(c) (1) Fusible plugs shall be cleaned and will be examined by the marine inspector at each inspection for certification, and oftener, if necessary. If in the marine inspector's opinion the condition of any plug is satisfactory, it may be continued in use.

(2) When fusible plugs are renewed at other than the inspection for certification and no marine inspector is in attendance, the chief engineer shall submit a written report to the Officer in Charge, Marine Inspection, who issued the Certificate of Inspection informing him of the renewal. This letter report shall contain the following information:

(i) Name and official number of vessel.

(ii) Date of renewal of fusible plugs.

(iii) Number and location of fusible plugs renewed in each boiler.

(iv) Manufacturer and heat number of each plug.

(v) Reason for renewal.

(d) Fusible plugs shall be so fitted that the smaller end of the filling is exposed to the fire, and shall be at least 1 inch higher on the water side than the plate or flue in which they are fitted.

(e) Notwithstanding anything which may be contained in this section, fusible plugs shall be so fitted that the end of the filling on the water end of the plug is not less than 1 inch above the dangerous low-water level.

**§ 67.50–25 Gage cocks and water glass.**

(a) All boilers, except flash boilers, shall be supplied with at least one reliable water gage, and at least three gage cocks attached directly to each boiler. When the gage glass and gage cocks are connected to the boilers by a water column there shall be three additional gage cocks inserted in the head or shell of boiler. The lower gage cock in boilers more than 48 inches in diameter shall be not less than 4 inches above the top of the flues, tubes, or combustion chambers. In boilers less than 48 inches in diameter the lower gage cock shall be not less than 2½ inches above the top of the flues, tubes, or combustion chambers. A gage glass shall be considered a reliable water gage, and a float such as used on western river steamers shall be considered on such boilers as a reliable water gage: *Provided,* That when water-tube boilers have an efficient water column connected to the steam drum of said boiler at the top and the water manifold at the bottom, and such water column has a gage glass and three gage cocks fitted to same, and also is fitted with a valve or stopcock, both at top and bottom where the column is connected to the boiler, no gage cocks shall be required in the head or shell of the drums of such water-tube boilers.

(b) Double-end boilers shall have at least three gage cocks and one water glass at each end.

(c) In vertical boilers of the water-tube type the location of the lowest gage cock shall be determined by the Officer in Charge, Marine Inspection.

**§ 67.50–30 Steam gages.**

All boilers or sets of boilers shall have attached to them at least one gage that will correctly indicate a pressure of steam equal to 80 percent of the hydrostatic pressure applied by the inspectors.

## Subpart 67.55—Evaporators, Feed-Water Heaters, Separators, and Steam Traps Made of Cast Iron and Subject to Boiler Pressure

**§ 67.55–1 Computations.**

(a) When evaporators, feed heaters, separators, and steam traps are constructed of cast iron possessing a tensile strength of not less than 20,000 pounds per square inch, the shells being cylindrical and ends flat or convex, the castings sound and of uniform thickness, the maximum allowed pressure shall be determined by the following formulas:

(1) For flat surface:

$$P=\frac{20{,}000\times T^2}{D^2} \quad (1)$$

$$T=\sqrt{\frac{P\times D^2}{20{,}000}} \quad (2)$$

(2) For cylindrical shell:

$$P=\frac{3{,}500\times T}{D} \quad (3)$$

$$T=\frac{P\times D}{3{,}500} \quad (4)$$

where:

$P$=maximum allowable pressure in pounds per square inch.

$T$=thickness, in inches.

$D$=diameter inside, in inches. When the pressure is to be determined for a part of a flat surface which is a square, or rectangle in the flat-surface formula, the value of $D$ used shall be the diagonal of the square or rectangle, and when the ends are bolted to the shell the value of $D$ used shall equal the diameter of the bolt circle.

(b) The thickness of ends of evaporators, feed heaters, and separators shall be not less than ⅜ inch. To the resultant thickness obtained by the formula given above there shall be added, for cylinders having an inside diameter of 1 inch to 6 inches, inclusive, ¼ inch; for cylinders having an inside diameter of over 6 inches to 15 inches, inclusive, ⅛ inch.

(c) All flanges shall be substantial, and there shall be a good fillet all around the root, and when the ends and shell are cast solid there shall be a good and substantial fillet inside all around.

(d) The bolts or studs for the ends or doors shall not have a greater stress than 6,000 pounds per square inch, and the size of bolts or studs shall be not less than ¾ inch in diameter.

### § 67.55–5 Evaporators.

Evaporators shall be provided with an efficient safety valve of approved type, set to blow at the maximum pressure to which the evaporator will be subjected in service, and it shall be the duty of the engineer in charge of the vessel to see that such valve blows off at least once in 30 days.

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## PART 68—PIPING SYSTEMS

### Subpart 68.01—General


Sec.
68.01–1 Scope.
68.01–5 Definitions.
68.01–10 Affidavit.

Subpart 68.05—Detail Requirements

68.05–1 Material.
68.05–5 Computations.
68.05–10 Valves and fittings.
68.05–13 Joints and flanged connections.
68.05–15 Installation.
68.05–20 Fuel oil filling and transfer system.
68.05–25 Fuel-oil service systems.
68.05–30 Vent piping.
68.05–35 Sounding pipes.
68.05–40 Welded piping.


AUTHORITY: The provisions of this Part 68 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426–4431, as amended, 4433, as amended, 4434, as amended, 4463, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404–409, 411, 412, 435, 481, 489, 366, 395, 363, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857.

### Subpart 68.01—General

### § 68.01–1 Scope.

(a) This part contains requirements for the various ships' piping and appurtenances.

(b) The respective piping systems installed on vessels shall have the necessary pumps, valves, regulating valves, safety valves, relief valves, flanges, fittings, pressure gages, liquid level indicators, thermometers, etc., for safe and efficient operation of the vessel.

### § 68.01–5 Definitions.

(a) *Piping.* The word "piping" within the meaning of this subchapter, refers to fabricated pipes or tubes with flanges and fittings attached, for use in the conveyance of vapors, gases or liquids, regardless of whether the diameter is measured on the inside or the outside.

(b) *Nominal diameter.* The term "nominal diameter" as used in this part, means the commercial diameter of the piping.

(c) *Fitting.* The term "pipe fittings" refers to all hollow cylindrical fittings, and does not apply to flanges or valves.

### § 68.01–10 Affidavit.

(a) When the manufacturers of steam and water pipes file with the Commandant a certificate duly sworn to that all such pipes manufactured by them will stand all the tests and meet all the applicable requirements of this chapter, they shall be accepted by inspectors of the Coast Guard.

(b) The manufacturer of valves and fittings shall file with the Commandant a certificate duly sworn to that all valves and fittings furnished by him for use on steam vessels comply with the requirements of this subchapter.

(c) After July 1, 1911, the Officer in Charge, Marine Inspection, shall refuse to allow the use of any valves or fittings on steam vessels until notified by the Commandant that such certificate is on file in his office. This shall not apply to valves and fittings installed previous to July 1, 1911.

### Subpart 68.05—Detail Requirements

### § 68.05–1 Material.

(a) Welded steam and water pipes may be permitted for pipe diameters from ⅛ inch inside diameter up to and including 30 inches inside diameter. The pipe shall be made of wrought iron or mild steel, smooth, straight, and free from defects. Threaded pipe of standard thickness shall be avoided as far as possible. In steam pipes it is a very serious matter and shall not be allowed in any case on standard pipe over 5 inches in diameter. All pipe over 2 inches in diameter shall be lap-welded.

(b) Cast-steel fittings of any size or character and for any pressure and for any temperature may be used for any and all steam and feed-pipe connections, and for valves, cocks, and all appliances subject to steam or water pressure, when made by regular processes and by manufacturers who stamp such fittings and appliances with their trade-mark or identifying stamp and who guarantee the castings to possess the following physical characteristics: Tensile strength, minimum, 50,000; maximum, 78,000 pounds per square inch; elastic limit, minimum, not less than 45 percent of tensile strength; elongation in 2 inches, minimum, 25 percent. There shall be taken from each heat an annealed coupon or coupons, for the purpose of determining the physical tests, and the manufacturers shall furnish coupons to the Officer in Charge, Marine Inspection, for tests when so required. All steel castings shall be thoroughly annealed.

(c) Cast iron, semisteel, or ferrosteel, possessing a tensile strength of not less than 22,000 pounds to the sectional square inch, may be used in the construction of valves and fittings for pressures not exceeding 300 pounds when such valves and fittings of 3 inches diameter or over are stamped with the trade-mark or identifying stamp of the manufacturer.

(d) Malleable iron possessing a tensile strength of not less than 30,000 pounds to the sectional square inch may be used in the construction of valves and fittings up to and including 6 inches in diameter, and for pressures not exceeding 300 pounds. Such valves and fittings of 3 inches diameter or over shall be extra heavy, the fitting beaded or banded, and the valves and fittings stamped with the trade-mark or identifying stamp of the manufacturer.

(e) Hard brass, bronze, and other compositions, of which 95 percent is copper, tin, and zinc, possessing a tensile strength of not less than 30,000 pounds to the square inch, may be used in the construction of all valves and fittings up to and including 12 inches in diameter. All such fittings of 3 inches in diameter or over shall be stamped with the trade-mark or identifying stamp of the manufacturer.

(f) The following material shall be permitted at the allowable temperatures indicated:

(1) Cast iron, malleable iron, semisteel, and ferrosteel may be used in connection with temperatures up to and including 450 degrees F.

(2) Hard brass, bronze, and other compositions, of which 95 percent is copper, tin, and zinc, may be used in connection with temperatures up to and including 470 degrees F., but this temperature may be increased to 550 degrees F. when the manufacturer of the valves

or fittings stamps them with the temperature they are guaranteed to stand without disintegration. This paragraph will also apply to any composition meeting the above physical requirements and stamped in accordance therewith.

(3) For temperatures exceeding 550 degrees F. no valves or fittings other than steel or of a composition whose tensile strength has been demonstrated to exceed 50,000 pounds per sectional square inch with an elongation of 10 percent in a length of 2 inches shall be allowed. Such valves and fittings shall be stamped as above required.

**§ 68.05–5 Computations.**

(a) *Steel and iron pipe.* (1) Thickness of and pressure allowed on main steam pipe constructed of riveted iron or steel plates that have been stamped and tested as required by R.S. 4430 (46 U.S.C. 408), shall be determined in the same manner as required by R.S. 4433 (46 U.S.C. 411), to determine the pressure allowable on boilers.

(2) The thickness of and maximum allowable pressure on all lapwelded or solid-drawn steam pipe of wrought iron or steel shall be determined by the following formulas:

$$T=\frac{P\times D}{10{,}000}+0.125 \qquad (1)$$

$$P=\frac{(T-0.125)\times 10{,}000}{D} \qquad (2)$$

where:

$P$ = maximum allowable pressure, in pounds per square inch.
$T$ = thickness of pipe, in inches.
$D$ = diameter of pipe, in inches.

(b) *Copper pipe.* (1) The thickness of copper pipe, according to the maximum allowable pressure, shall be determined by the following formulas:

$$T=\frac{P\times D}{8{,}000}+0.0625 \qquad (3)$$

where:

$T$ = thickness, in inches.
$P$ = maximum allowable pressure, in pounds per square inch.
$D$ = inside diameter of pipe, in inches.

(2) All copper pipe subject to pressure and installed for use on steam vessels after July 1, 1911, shall have a thickness of material according to the maximum allowable pressure, to be determined by the following formula:

$$T=\frac{P\times D}{6{,}000}+0.0625 \qquad (4)$$

where:

$T$ = thickness, in inches.
$P$ = maximum allowable pressure, in pounds per square inch.
$D$ = inside diameter of pipe, in inches.

(c) *Steel fittings.* The minimum thickness of steel fittings shall be determined by the following formula:

$$T=\frac{P\times D}{7{,}000}+0.188 \qquad (5)$$

where:

$P$ = maximum allowable pressure, in pounds per square inch.
$D$ = diameter, in inches.
$T$ = thickness, in inches.

(d) *Cast iron fitting.* The minimum thickness of cast iron, semisteel, or ferrosteel fittings shall be determined by the following formula:

$$T=\frac{P\times D}{3{,}000}+0.25 \qquad (6)$$

where:

$T$ = thickness of casting, in inches.
$P$ = maximum allowable pressure, in pounds per square inch.
$D$ = internal diameter of the largest opening contained in the cylindrical part of the casting in inches.

(e) *Nonferrous slip joints.* (1) The wearing surface of the male pipe in all slip joints made after June 30, 1908, for use in steam pipes shall be made of copper or composition, and shall be of sufficient length and so adjusted as to prevent accidental withdrawal from the packing box. When made of composition, same shall be of not less than 95 percent copper, tin, and zinc, possessing a tensile strength of not less than 30,000 pounds to the square inch. It may be used for sizes up to and including 12 inches in diameter, and for all pressures not exceeding 300 pounds per square inch.

(2) The minimum thickness of such fittings shall be determined by the following formula:

$$T=\frac{P\times D}{4{,}000}+0.22 \qquad (7)$$

where:

$P$ = maximum allowable pressure, in pounds per square inch.
$D$ = diameter, in inches.
$T$ = thickness, in inches.

**§ 68.05–10 Valves and fittings.**

(a) Valves and fittings of 3 inches and under may be connected by screw threads at their intermediate joints in pipe lines.

(b) Each and every valve for marine service shall have the trade-mark of the manufacturer cast or stamped on the chamber. All such valves of 2 inches diameter and over shall be subjected by the manufacturer before shipment to a hydrostatic pressure of three times the working pressure which the manufacturer guarantees them to stand without distorting, and shall also be stamped with such working pressure and also the letters "M. S." which shall plainly indicate that the valve has met the test requirements for marine service.

(c) All valves of over 2 inches diameter, without regard for the service for which they are intended, installed after April 30, 1917, shall have bolted bonnets.

(d) Screwed bonnets on cast-iron valves of any size and for any character of service are positively prohibited.

(e) All pipe fittings of more than 3 inches internal diameter shall be subjected by the manufacturer to a test of three times the pressure to which they will be subjected in service.

**§ 68.05–13 Joints and flanged connections.**

(a) *Flanges and connections for wrought-iron and homogeneous-steel feed and steam pipe.* (1) The terminal and intermediate flanges of all wrought-iron and homogeneous-steel feed and steam pipe over 2 inches in diameter, other than on pipe or coil boilers of steam generators, shall be made of wrought iron, homogeneous steel, malleable iron having a tensile strength of not less than 30,000 pounds per square inch of section, or equivalent material.

(2) All such flanges shall have a depth through the bore of not less than one-half of the diameter of the pipe to which the flange is attached.

(3) The bore shall increase slightly toward the face of the flange, and the end of the pipe shall be enlarged to fit the bore of the flange and shall be substantially beaded over or outward into a recess in the face of the flange.

(4) Flanges on extra heavy lap-welded steam pipe up to and including 5 inches diameter may be attached with screw threads and the joints in bends may be made with extra heavy malleable-iron elbows or equivalent material.

(5) Feed and steam pipe up to and including 3 inches diameter may be connected at intermediate joints by being screwed into flanges or extra heavy fittings.

(6) Flanges of cast iron, semisteel, or ferrosteel, having a tensile strength of not less than 20,000 pounds per square inch of section, may be employed in connecting extra heavy lap-welded pipe by screw threads. Such flanges shall be extra heavy and have a depth through the bore of not less than the United States standard length of thread for the pipe to which the flange is attached plus depth of counterbore. The thickness of the flange, excluding hub, shall be not less than three-tenths of the diameter of the pipe plus 0.25 of an inch. The pipe shall fit snugly in the counterbore, which shall be not less than one-fourth the diameter of the pipe in depth.

(7) Flanges of wrought iron or steel grooved in the bore to a depth equal to the thickness of the material in the pipe shall be allowed for use on all steam and feed pipe when the end of the pipe has been thoroughly annealed and expanded into the flange by approved machinery.

(8) Flanges with hubs projecting not less than 1¾ inches from the back of the flange may be shrunk on lapwelded or riveted-iron or steel or seamless-drawn steel steam pipes over 5½ inches diameter where the pipe is brought to a true and parallel circle at the end and beaded over into a recess at the face of the flange, or flared to an angle of approximately 20 degrees or the bore of the flange may be tapered and the pipe expanded into the bore.

(9) Flanges of cast steel, wrought iron, or homogeneous steel, equal in strength to the pipe to which it is attached, may be riveted to the pipe. When pipe is used for steam lines where flanges are riveted on and calked, the ends of the pipe shall be properly annealed before drilling or riveting the flanges on.

(10) Flanges may be secured to pipe by expanding the pipe by proper and approved machinery and flaring the end of the pipe to an angle not exceeding 20 degrees, taken in the direction of the length of the pipe, and having a depth of flare equal to at least one and one-half times the thickness of the pipe.

(11) Flanges of cast steel, forged steel, or wrought iron may be used in any process of expanding the pipe into grooves in the bore of the flange and flaring the end of the pipe to an angle of 20 degrees.

(12) Flanges welded to lapwelded steam pipes of iron or steel may be used when the manufacturer furnishes an affidavit that the pipe has been properly annealed after all work requiring fire has been finished.

(13) All flange connections made by the process of expanding, welding, or shrinking shall be subjected to a hydrostatic test of twice the working pressure without showing signs of weakness.

(b) *Flanges on copper pipe.* (1) The flanges of all copper steam and feed pipe over 3 inches diameter shall be made of brass or bronze composition, forged-iron, or steel or open-hearth steel castings. The end of the pipe shall be flanged over or outward to a width of not less than twice the thickness of the pipe and to a radius of not more than the thickness of the pipe, and the flange securely brazed or riveted to the pipe. If the pipe is properly formed with a full reinforced taper through the flange, the riveting or brazing may be dispensed with. The thickness of flanges shall be not less than four times the required thickness of the pipe plus 0.25 of an inch.

(2) Any form of expanded, grooved, and flared joint will be allowed for copper pipe under the same regulations, restrictions, and tests applying to iron or steel pipe.

(3) All flange joints shall be fitted with such number of bolts or rivets as will make the joint equal in strength to all other parts of the pipe.

(4) Any form of joint which, in the judgment of the Officer in Charge, Marine Inspection, is equal in strength and efficiency to the flange connections required by this section shall be allowed on any and all classes of pipe.

**§ 68.05–15 Installation.**

(a) Where vent and sounding pipes pass through cargo spaces they shall be protected against damage.

(b) No copper pipe constructed after June 30, 1905, shall have any bend whose radius is less than one and one-half times the diameter of the pipe and such pipe shall be so led and flanges so placed that they may be readily taken down if required. Such pipes shall be protected by iron casings when run through coal bunkers, and shall be clear of the coal chutes.

(c) All sea valves or cocks secured to the skin of the vessel by bolts and connected to the engines or boilers by pipes shall be arranged so as to be accessible at all times, so that if a leak or defect occurs it can be reached. All parts of said valves except the chamber shall be made of brass or bronze when used on wooden-hull vessels navigating salt water; but in the case of vessels of iron or steel the brass or bronze bolts may be dispensed with.

**§ 68.05–20 Fuel oil filling and transfer system.**

(a) *Ocean and coastwise.* (1) The construction of fuel-oil tanks separate from the hull shall conform to the following requirements: Plating for such tanks shall be not less than 5/16 inch in thickness; seams where the plates are joined shall be double-riveted; all rivet holes shall be fairly drilled, or punched three-fourths diameter and reamed to size; rivet holes shall be spaced not to exceed four diameters; and, where practicable, the tanks shall be caulked inside and out.

(2) Where double bottoms are used for the storage of fuel oil, such double bottoms shall be subdivided with one or more longitudinal watertight bulkheads, except the narrow tanks at the forward and after ends of the vessel. This requirement shall also apply to fuel-oil deep tanks which shall also be fitted with the necessary swash plates. The hatch covers on deep tanks which are used for fuel oil shall be made of steel or iron plating and be fitted oiltight. Fuel-oil tanks in 'tween-deck spaces overhanging the boiler space or adjoining the ship's sides abreast of the boilers shall be avoided as far as practicable, but where found to be necessary, they shall be subdivided into compartments not exceeding 20 feet in length.

(3) The test for fuel-oil tanks that do not form a part of the structure of the hull shall be a hydrostatic test of 15 pounds to the square inch, and all other tanks shall be tested with a pressure that will not be exceeded in practice.

(4) Deep tanks, peak tanks, settling tanks, and tanks separate from the hull used for the storage of fuel oil shall be fitted with internal gate valves where the suction pipe or pipes penetrate the tank, the valves to be fitted with mechanical appliances so arranged that they may be operated from an accessible place on deck outside of the machinery space. Double-bottom fuel-oil tanks shall be fitted with a gate valve on the tank top where the suction pipe penetrates it, or, where the suction pipe leads under the tank tops, the valve shall be placed where the pipe enters the machinery space.

(b) *Great Lakes; lakes, bays, sounds, and rivers.* (1) The fuel-oil tanks on all inland steamers subject to the requirements in this subchapter shall be constructed of material of such thickness and workmanship as, in the judgment of the inspector where the installation is made, is safe.

(2) All pipe connections on fuel-oil tanks and cargo-oil tanks, except the connection or connections on the top of such tank, shall be protected by an internal gate valve operated by an extension rod leading to an accessible point in an open space on a deck outside the engine and fireroom casing, so that the flow of oil may be immediately shut off in the case of failure or rupture of any of the pipes or connections.

(c) No openings are to be cut in the bottoms, ends, or sides of fuel-oil tanks except for suction and heater connections.

(d) All pipes over 2 inches in diameter shall be attached to fuel-oil tanks by flanges, or flanged fittings, riveted to the tanks. Filling pipes for such tanks shall extend through the top of the tank to bottoms of the tanks and fitted with U-bends extending upward at least 12 inches above the bottoms; or in lieu of the U-bends the pipes may be led to within one-half of the diameter of the pipes from the bottom of the tanks.

**§ 68.05–25 Fuel-oil service systems.**

(a) The piping between the service pumps and the stop valve at the burners, when the pressure exceeds 15 pounds per square inch, shall be extra-heavy seamless piping and shall be in sight above the floor or platform. The connections on such piping shall be made with extra-heavy flanges or extra-heavy fittings of forged or cast steel, bronze, or malleable iron. Valves on pipe lines conveying hot oil shall be extra heavy and shall be of the locked-bonnet, bolted-bonnet, or union-nut-bonnet type.

(b) The piping, including connections, shall be tested in place to a hydrostatic test pressure equal to three times the designed maximum working pressure, but in no case less than 150 pounds. All other piping for use in conveying fuel oil, together with valves, and fittings, shall be suitable for a pressure of 125 pounds and all such pipe and fittings between the gate valve within the tank and the pumps shall be tested to a hydrostatic pressure of 250 pounds.

(c) When it is desired to change a low-pressure system to a high-pressure system, it will be necessary to apply a hydrostatic test pressure to the piping and connections from pumps to burners equal to three times the working pressure.

(d) All oil heaters shall be tested to double the working pressure. Continuous pipe or pipes shall be carried through the heads or ends of the heaters, and all joints shall be made on the outside to eliminate the danger of oil being pumped into the boilers in the event of failure of the joints: *Provided,* That this requirement does not apply when the water of condensation from the heaters is led to an observation tank or is not used for boiler-feed water. Heaters may be installed in double-bottoms, if so desired, when vessels are operating in cold waters and may be placed in the most convenient location for heating the oil.

(e) Fuel-oil pumps supplying oil to the burners, also oil strainers, shall be in duplicate, and the discharge of each pump shall be fitted with an efficient relief valve that will return surplus oil to the suction side of the pumps.

(f) Throttle valves on fuel-oil pumps shall be arranged so that they may be operated from some accessible point outside of the pump-room or fireroom inclosure.

**§ 68.05–30 Vent piping.**

(a) The vent pipes from all fuel-oil tanks shall have a net cross-sectional area equal to that of the filling pipes and shall be led from the top of the tank to the open air in a space where no danger will result from the discharge of oil vapor; the discharge ends to be fitted

with U-bends and a gauze diaphragm, which can be easily removed for cleaning.

(b) Where it is necessary to use bends in the piping, such bends shall not exceed 45 degrees from the vertical.

**§ 68.05–35 Sounding pipes.**

(a) Sounding pipes or other reliable apparatus shall be fitted to fuel tanks for use in determining the oil level in each tank. Sounding pipes shall be led up through the deck and down to within one diameter of the bottom of the tank, and shall not be perforated.

(b) Sounding pipes in the machinery spaces that do not extend up through a deck shall be fitted with a valve or stopcock that will close automatically to prevent oil overflow.

**§ 68.05–40 Welded piping.**

(a) Fusion butt welding may be used to join bilge, ballast, fuel-oil overflow, fuel-oil transfer and vent pipes, fire and flushing mains, fresh water distribution, brine piping, and drain suctions from fuel-oil tanks.

(b) Heating coils in fuel-oil tanks may also be joined by fusion welding, provided butt welds are used and the welds protected by a sleeve, fillet welded at the ends of the wall of the pipe.

(c) In all cases, such welding shall comply with the requirements of Subchapter F (Marine Engineering) of this chapter.

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# PART 69—INSTALLATIONS, TESTS, INSPECTIONS, AND REPAIRS

Subpart 69.01—Installations

Sec.
69.01–1 Protection of adjacent structure.
69.01–5 Dampers.

Subpart 69.05—Tests and Inspections

69.05–1 Test and inspection of new boilers.
69.05–5 Nameplates.
69.05–10 Tests and inspection of boilers and main steam piping in service.
69.05–15 Donkey boilers.
69.05–20 Inspection of foreign-built boilers admitted to American Registry.
69.05–25 Inspection of boilers on existing barges.

Subpart 69.10—Repairs

69.10–1 Welding repairs.

AUTHORITY: The provisions of this Part 69 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4417a, as amended, 4418, as amended, 4421, as amended, 4426–4431, as amended, 4433, as amended, 4434, as amended, 4453, as amended, 4488, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 391a, 392, 399, 404–409, 411, 412, 435, 481, 489, 366, 395, 363, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857.

## Subpart 69.01—Installations

**§ 69.01–1 Protection of adjacent structure.**

(a) Externally heated boilers shall have a clear space between the boiler and the woodwork of not less than 6 inches at the sides and 4 inches at the top.

(b) Internally heated boilers shall have a clear space between the boiler and the woodwork of not less than 4 inches at the sides and 4 inches at the top.

(c) All woodwork or other ignitible substance approaching within 12 inches of the boiler or smokestack (unless such boiler or smokestack is covered with good nonconducting material) shall be suitably sheathed with metal over noncombustible material and all woodwork or other ignitible substance in or around the fireroom shall be properly protected by metal or asbestos sheathing.

(d) All boilers hereafter placed in wooden steamers shall have a clear space of at least 8 inches between the underside of the cylindrical shell and the floor or keelson; and on all other steamers the boilers shall be so placed as to permit of proper inspection of the underside thereof.

(e) All water-tube or coil boilers shall have a clear space of not less than 4 inches between the back end of boiler and bulkhead. All other boilers shall have a clear space of not less than 2 feet between the back end of boiler and bulkhead.

(f) Where fuel-oil tanks are fitted in wooden vessels, lead pans or lining shall be placed under the tanks, the lead to be of a gage weighing not less than 8 pounds per square foot, this precaution being made to prevent oil from getting into the bilges of the vessel.

(g) Suitable drip pans shall be installed to catch the drip from burners, fuel-oil pumps, strainers, or any other place where necessary to prevent oil from reaching the bilges of the vessel.

(h) The boiler room and funnel casings shall be insulated so as to prevent the spread of fire to woodwork or other combustible material adjacent to the casings in the event of an oil fire taking place in the fireroom.

**§ 69.01–5 Dampers.**

(a) Dampers in funnels or uptakes on oil-burning steamers shall be fitted with a locking device in open position.

## Subpart 69.05—Tests and Inspections

**§ 69.05–1 Test and inspection of new boilers.**

(a) All coil and pipe hereafter made, when such boiler is completed and ready for inspection, shall be subjected at the first inspection to a hydrostatic pressure at a ratio of 150 pounds to a steam pressure of 100 pounds.

**§ 69.05–5 Nameplates.**

(a) There shall be fastened to each boiler a plate containing the name of the manufacturer of the material, the place where manufactured, the tensile strength, the name of the builder of the boiler, when and where built.

(b) The date of the building of the boiler or boilers shall be determined by the month and year of issue of the first certificate of inspection which covers the boiler or boilers in question: *Provided*, That the boiler or boilers have not been used for any purpose previous to the inspection.

**§ 69.05–10 Tests and inspection of boilers and main steam piping in service.**

(a) The hydrostatic pressure applied to boilers which can be satisfactorily examined internally shall be in the proportion of 125 pounds to the square inch to 100 pounds to the square inch of the steam pressure allowed; types of boilers which due to design cannot be examined internally shall be subjected to a hydrostatic pressure in the proportion of 150 pounds to the square inch to 100 pounds to the square inch of the steam pressure allowed. The inspector, after applying the hydrostatic test, shall thoroughly examine every part of the boiler. The hydrostatic pressure shall also be applied to the main steam pipe up to the throttle.

(b) In the application of the hydrostatic pressure to boilers, inspectors shall require such arrangements as will guard against main and auxiliary stop valves being subjected to hydrostatic pressure on one side at the same time that steam pressure is exerted on the opposite side.

(c) Steamers on going out of service or laying up in winter quarters and beginning the annual inspection may have the hydrostatic pressure applied to boilers at any time preceding the date of the final completion of the inspection, so that, however, in no instance shall the vessel be navigated to exceed 12 months without the hydrostatic pressure.

(d) Inspectors are required at each annual inspection to carefully inspect the flues of every boiler and subject them to the hammer test where possible or practicable in order that deterioration of material may be detected. If such test indicates thin material, the doubtful place shall be drilled and the material carefully gaged in order that the safe pressure may be determined; or if the flue is found to deviate from the form of a practically true circle, the pressure shall be reduced accordingly. The efficiency and workmanship of the riveted seams shall also be carefully observed at all inspections.

(e) The Officer in Charge, Marine Inspection, in determining the distance between the flues and the shells of externally fired boilers, under provisions of R. S. 4434 (46 U. S. C. 412), shall take the measurements from the plate in the flue to the plate in the shell on vessels in river service only.

(f) The shell of any boiler which has reached the age of 10 years shall, at the first annual inspection thereafter, and at such subsequent periods as the Officer in Charge, Marine Inspection, or Coast Guard District Commander may deem necessary, be drilled near the water line and at such other points in the shell as

may be necessary to determine as nearly as possible the thickness of material, which ascertained thickness, together with the general condition of the boiler, shall govern the maximum allowable pressure. If the thickness found by actual measurement is less than the original thickness, the maximum allowable pressure shall be recalculated using the thinnest portion of the shell plate as the thickness of the shell, and shall not exceed the maximum pressure permitted by the applicable boiler design formulas. For the purpose of such recalculation, the design formulas specified in this subchapter may be used for boilers made or contracted for prior to July 1, 1935, or alternatively the design formulas set forth in Subchapter F (Marine Engineering) may be used.

**§ 69.05–15 Donkey boilers.**

Donkey boilers shall be inspected in the same manner as the main boilers.

**§ 69.05–20 Inspection of foreign-built boilers admitted to American Registry.**

(a) Boilers of foreign-built vessels admitted to American registry shall be inspected in the same manner as boilers on American vessels.

(b) The working steam pressure shall be determined by the application of the hydrostatic pressure in the ratio as required by the laws of the United States and by a close observation of the general condition of the boiler.

(c) The working steam pressure under which the boilers are being operated shall be accepted as the basis for determining the allowable working pressure where it is not practicable or possible to secure a record of the tests of the plates entering into the construction of the boiler.

**§ 69.05–25 Inspection of boilers on existing barges.**

Boilers on existing barges required to be inspected and not constructed according to the specifications prescribed by the Commandant may be considered the same as foreign-built boilers as specified in § 69.05–20, and so treated.

## Subpart 69.10—Repairs

**§ 69.10–1 Welding repairs.**

(a) No repair work by any welding process other than fusion welding shall be allowed on main boilers or unfired pressure vessels until coupons showing the character of the work proposed to be done by the applicant shall have been tested and submitted, with an explanation and report of the test, to the Officer in Charge, Marine Inspection, at or nearest the place where the work is to be done. The Officer in Charge, Marine Inspection, shall then satisfy himself whether or not such process can be used with safety on the boilers or unfired pressure vessels of steam vessels.

(b) In every case where repairs are to be made by these processes on boilers or unfired pressure vessels of steam vessels subject to the inspection of the Coast Guard, the engineer in charge and the parties making the repairs are required to notify the Officer in Charge, Marine Inspection, giving full detailed description of the repairs to be made, the location of the vessel, and the time the repairs are to be begun, so that inspection may be had, if practicable, prior to and during the time the work is being done, which reports must be confirmed in writing to the Officer in Charge, Marine Inspection.

(c) The application for permission to use these processes on boiler or unfired pressure vessel repairs of any particular vessel implies a guaranty on the part of the applicant that the work shall, in material, flux, and workmanship, be equal to that of the samples furnished.

(d) Repairs to marine boilers and unfired pressure vessels by means of fusion welding may be permitted provided such welding conforms to the requirements of Subchapter F (Marine Engineering) of this chapter.

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SUBCHAPTER H—PASSENGER VESSELS

# PART 70—GENERAL PROVISIONS

### Subpart 70.01—Authority and Purpose

Sec.
70.01–1 Purpose of regulations.
70.01–5 Assignment of functions.
70.01–10 Authority for regulations.

### Subpart 70.05—Application

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70.10–1 Approved.
70.10–2 Barge.
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70.10–7 Classed vessel.
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70.10–21 International voyage.
70.10–23 Lakes, bays, and sounds.
70.10–25 Marine inspector or inspector.
70.10–29 Motor vessel.
70.10–30 Nuclear vessel.
70.10–31 Ocean.
70.10–33 Officer in Charge, Marine Inspection.
70.10–35 Passenger.
70.10–37 Rules of the Road.
70.10–39 Rivers.
70.10–41 Recognized classification society.
70.10–42 Sailing vessel.
70.10–43 Short international voyage.
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### Subpart 70.15—Equivalents

70.15–1 Conditions under which equivalents may be used.

### Subpart 70.20—General Marine Engineering Requirements

Sec.
70.20–1 Marine engineering details.
70.20–5 Nuclear vessels.

### Subpart 70.25—General Electrical Engineering Requirements

70.25–1 Electrical engineering details.

### Subpart 70.30—Special Provisions

70.30–1 Vessels acquired or documented under the act of Aug. 9, 1954.
70.30–5 Installations of equipment made during the unlimited national emergency declared by the President on May 27, 1941.

### Subpart 70.35—American Bureau of Shipping's Standards

70.35–1 Standards to be used.
70.35–5 Where obtainable.

AUTHORITY: The provisions of this Part 70 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4421, as amended, 4426, as amended, 4453, as amended, 4488, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, sec. 5, 49 Stat. 1384, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 404, 399, 435, 481, 366, 395, 363, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857, unless otherwise noted.

## Subpart 70.01—Authority and Purpose

**§ 70.01–1 Purpose of regulations.**

(a) The purpose of the regulations in this subchapter is to set forth uniform minimum requirements for passenger vessels in accordance with the intent of Title 52 of the Revised Statutes and acts amendatory thereof or supplemental thereto, as well as to implement various International Conventions for Safety of Life at Sea and other treaties which affect the merchant marine. The regulations are necessary to carry out the provisions of law affecting passenger vessels and such regulations have the force of law.

**§ 70.01–5 Assignment of functions.**

(a) By Reorganization Plan No. 3 of 1946, effective July 16, 1946, the marine inspection functions of the former Bureau of Marine Inspection and Navigation and its officers and employees were transferred to the Commandant, United States Coast Guard. By Reorganization Plan No. 26 of 1950 (15 F. R. 4935; 3 CFR, 1950 Supp., p. 178; 5 U. S. C. Note under 241), effective July 31, 1950, the functions formerly vested in the Commandant, United States Coast Guard, were transferred to the Secretary of the Treasury with certain specified exceptions. The Secretary of the Treasury by an order dated July 31, 1950 (15 F. R. 6521), delegated to the Commandant the functions formerly performed by him under Reorganization Plan No. 3 of 1946.

**§ 70.01–10 Authority for regulations.**

(a) *General.* (1) The authority to prescribe regulations generally is set forth in 46 U.S. Code, sections 375 and 416, as well as in certain other provisions in 46 U.S. Code, sections 170, 214, 215, 222, 224, 224a, 226, 228, 229, 230–234, 239, 240, 361, 362, 364, 372, 381, 391, 391a, 392, 393, 399, 400, 402–414, 435, 436, 451–453, 460, 461, 462, 464, 467, 470–482, and 489–498, and acts amendatory thereof or supplemental thereto. Under the provisions of 46 U.S. Code, section 372, the Commandant, United States Coast Guard, superintends the administration of the vessel inspection laws to produce a correct and uniform administration of the inspection laws, rules, and regulations.

(b) *Inspection and certification.* (1) The regulations regarding inspection and certification of passenger vessels interpret or apply 46 U.S. Code, sections 361, 362, 363, 367, 369, 390b, 391, 392, 395, 399, 400, 404, 406–408, 411, 412, 435, 660a, and 1333, and 50 U.S. Code, section 198.

(c) *Construction and arrangement.* (1) The regulations regarding the construction and arrangement of passenger vessels interpret or apply 46 U.S. Code, sections 363, 367, 369, 390b, 391, 392, 404, 481–483, and 1333, and 50 U.S. Code, section 198.

(d) *Subdivision.* (1) The regulations regarding subdivision of passenger vessels interpret or apply 46 U.S. Code, sections 85a, 88a, 363, 367, 369, 390b, 391, 392, 404, 482, 483, and 1333 and 50 U.S. Code, section 198.

(e) *Stability.* (1) The regulations regarding stability of passenger vessels interpret or apply 46 U.S. Code, sections 85a, 88a, 363, 367, 369, 390b, 391, 392, 404, 482, 483, and 1333, and 50 U.S. Code, section 198.

(f) *Lifesaving equipment.* (1) The regulations regarding lifesaving equipment of passenger vessels interpret or apply 46 U.S. Code, sections 367, 390b, 391, 392, 404, 481, 489, 526p, and 1333, and 50 U.S. Code, section 198.

(g) *Fire protection and equipment.* (1) The regulations regarding fire protection equipment of passenger vessels interpret or apply 46 U.S. Code, sections 367, 390b, 391, 392, 404, 470, 481, 526p, and 1333, and 50 U.S. Code, section 198.

(h) *Vessel control and miscellaneous systems and equipment.* (1) The regulations regarding vessel control and miscellaneous systems and equipment of passenger vessels interpret or apply 46 U.S. Code, sections 363, 367, 390b, 391, 392, 404, 526p, and 1333, and 50 U.S. Code, section 198.

(i) *Operations.* (1) The regulations regarding operations of passenger vessels interpret or apply 46 U.S. Code, sections 367, 390b, 391, 392, 404, 435, 526p, and 1333, and 50 U.S. Code, section 198.

## Subpart 70.05—Application

**§ 70.05–1 United States flag vessels subject to the requirements of this subchapter.**

(a) This subchapter shall be applicable to all United States flag vessels indicated in Column 4 of Table 70.05–1(a) that are 100 gross tons or more, except as follows:

(1) Any vessel operating exclusively on inland waters which are not navigable waters of the United States; or,

(2) Any vessel while laid up and dismantled and out of commission; or,

(3) With the exception of vessels of the U. S. Maritime Administration, any vessel with title vested in the United States and which is used for public purposes.

**§ 70.05–3 Foreign vessels subject to the requirements of this subchapter.**

(a) Except as specifically noted in paragraph (b) of this section, this subchapter shall be applicable to the extent prescribed by law to all foreign vessels of the following classifications indicated in Column 4 of Table 70.05–1(a) that are 100 gross tons or more:

(1) Foreign vessels which carry more than 12 passengers from any port in the United States; or,

(2) Foreign vessels, other than those mentioned in subparagraph (1) of this paragraph, which carry more than 6 passengers from any port in the United States, and which are:

(i) Mechanically propelled vessels of not more than 15 gross tons; or,

(ii) Sailing vessels of not more than 700 gross tons; or,

(iii) Nonself-propelled vessels of not more than 100 gross tons.

(b) The provisions of this subchapter shall not be applicable to those foreign vessels covered by paragraph (a) of this section which are:

(1) Any vessel of a foreign nation signatory to the International Convention for Safety of Life at Sea, 1960, and which has on board a current valid safety certificate; or,

(2) Any vessel of a foreign nation having inspection laws approximating those of the United States together with reciprocal inspection arrangements with the United States, and which has on board a current valid certificate of inspection issued by its government under such arrangements.

(c) Notwithstanding the exceptions previously noted in paragraph (b) of this section, foreign vessels of novel design or construction, or whose operation involves potential unusual risks shall be subject to inspection to the extent necessary to safeguard life and property in United States' ports, as further provided by § 2.01–13 of Subchapter A (Procedures Applicable to the Public) of this chapter.

(R.S. 4472, as amended; 46 U.S.C. 170)

**§ 70.05–5 Specific application noted in text.**

(a) At the beginning of the various parts, subparts, and sections, a more specific application is generally given for the particular portion of the text involved. This application sets forth the types, sizes, or services or vessels to which the text pertains, and in many cases limits the application of the text to vessels contracted for before or after a specific date. As used in this subchapter, the term "vessels contracted for" includes not only the contracting for the construction of a vessel, but also the contracting for a material alteration to a vessel, the contracting for the conversion of a vessel to a passenger vessel, and the changing of service or route of a vessel if such change increases or modifies the general requirements for the vessel or increases the hazards to which it might be subjected.

**§ 70.05–7 Ocean or unlimited coastwise vessels on inland and Great Lakes Routes.**

(a) Vessels inspected and certificated for ocean or unlimited coastwise routes shall be considered suitable for navigation insofar as the provisions of this subchapter are concerned on any inland route, including the Great Lakes.

**§ 70.05–10 Application to vessels on an international voyage.**

(a) Where, in various places or portions of this subchapter, requirements are stipulated specifically for "vessels on an international voyage", it is intended that these requirements apply only to vessels subject to the International Convention for Safety of Life at Sea, 1960, which are mechanically propelled on an international voyage as defined in § 70.10–21, and certificated to carry more than 12 passengers.

(b) In accordance with Regulation 4, Chapter I (General Provisions), of the International Convention for Safety of Life at Sea, 1960, a vessel which is not normally engaged on an international voyage but which, in exceptional circumstances, is required to undertake a single international voyage may be exempted by the Commandant from any of the requirements of the Regulations of the Convention: *Provided,* That it complies with safety requirements which are adequate in his opinion for the voyage which is to be undertaken.

(c) In accordance with Regulation 1(c), Chapter II (Construction), of the International Convention for Safety of Life at Sea, 1960, the Commandant may, if he considers that the sheltered nature and conditions of the voyage are such as to render the application of any specific requirements of Chapter II of this Convention unreasonable or unnecessary, exempt from those requirements individual vessels or classes of vessels which, in the course of their voyage, do not proceed more than 20 miles from the nearest land.

(d) In accordance with Regulation 3(a), Chapter III (Lifesaving Appliances, Etc.), of the International Convention for Safety of Life at Sea, 1960, the Commandant, if he considers that the sheltered nature and conditions of the voyage are such as to render the application of the full requirements of Chapter III of this Convention unreasonable or unnecessary, may to that extent exempt from the requirements of Chapter III individual vessels or classes of vessels which, in the course of their voyage, do not go more than 20 miles from the nearest land.

TABLE 70.05-1(a)

| Method of propulsion | Size or other limitations [1] | Classes of vessels (including motorboats) examined or inspected under various Coast Guard regulations [1] | | | |
|---|---|---|---|---|---|
| | | Vessels inspected and certificated under Subchapter D—Tank Vessels [2] | Vessels inspected and certificated under either Subchapter H—Passenger Vessels [2] [3] [4] or Subchapter T—Small Passenger Vessels [2] [3] [4] | Vessels inspected and certificated under Subchapter I—Cargo and Miscellaneous Vessels [2] [3] | Vessels subject to provisions of Subchapter C—Uninspected Vessels [2] [4] |
| Column 1 | Column 2 | Column 3 | Column 4 | Column 5 | Column 6 |
| Steam | Vessels not over 65 feet in length. | All vessels carrying combustible or flammable liquid cargo in bulk. | All vessels carrying more than 6 passengers.[7] | All tugboats and towboats. | All vessels except those covered by columns 3, 4, and 5.[8] |
| | Vessels over 65 feet in length. | All vessels carrying combustible or flammable liquid cargo in bulk.[4] | 1. All vessels carrying more than 12 passengers on an international voyage, except yachts.<br>2. All vessels of not over 15 gross tons which carry more than 6 passengers.[7]<br>3. All other vessels carrying passengers, except:<br>a. Yachts.<br>b. Documented cargo or tank vessels issued a permit to carry not more than 16 persons in addition to the crew.<br>c. Towing and fishing vessels, in other than ocean and coastwise service, may carry persons on the legitimate business of the vessel, in addition to crew, but not to exceed one for each net ton of the vessel. | All vessels except those covered by columns 3 and 4. | None. |
| Motor | Vessels of not over 15 gross tons. | All vessels carrying combustible or flammable liquid cargo in bulk. | All vessels carrying more than 6 passengers.[7] | Those vessels carrying dangerous cargoes when required by 46 CFR Part 98 or 146. | All vessels except those covered by columns 3, 4, and 5. |
| | Vessels over 15 gross tons except seagoing motor vessels of 300 gross tons and over. | All vessels carrying combustible or flammable liquid cargo in bulk.[4] | 1. All vessels carrying more than 12 passengers on an international voyage, except yachts.<br>2. All vessels not over 65 feet in length which carry more than 6 passengers.[7]<br>3. All other vessels of over 65 feet in length carrying passengers for hire except documented cargo or tank vessels issued a permit to carry not more than 16 persons in addition to the crew. | All vessels carrying freight for hire except those covered by columns 3 and 4. | All vessels except those covered by columns 3, 4, and 5. |
| | Seagoing motor vessels of 300 gross tons and over. | All vessels carrying combustible or flammable liquid cargo in bulk.[4] | 1. All vessels carrying more than 12 passengers on an international voyage, except yachts.<br>2. All other vessels carrying passengers, except:<br>a. Yachts.<br>b. Documented cargo or tank vessels issued a permit to carry not more than 16 persons in addition to the crew. | All vessels except those covered by columns 3 and 4, and those engaged in the fishing, oystering, clamming, crabbing, or any other branch of the fishery, kelp, or sponge industry. | All vessels except those covered by columns 3, 4, and 5. |
| Sail | Vessels not over 700 gross tons. | All vessels carrying combustible or flammable liquid cargo in bulk. | All vessels carrying more than 6 passengers.[7] | Those vessels carrying dangerous cargoes when required by 46 CFR Part 98 or 146. | None. |
| | Vessels over 700 gross tons. | All vessels carrying combustible or flammable liquid cargo in bulk. | All vessels carrying passengers for hire. | Those vessels carrying dangerous cargoes when required by 46 CFR Part 98 or 146. | None. |
| Nonself-propelled | Vessels not over 100 gross tons. | All vessels carrying combustible or flammable liquid cargo in bulk. | All vessels carrying more than 6 passengers.[7] | Those vessels carrying dangerous cargoes when required by 46 CFR Part 98 or 146. | All barges carrying passengers except those covered by column 4. |
| | Vessels over 100 gross tons. | All vessels carrying combustible or flammable liquid cargo in bulk. | All vessels carrying passengers for hire. | All seagoing barges except those covered by columns 3 and 4; and those inland barges carrying dangerous cargoes when required by 46 CFR Part 98 or 146. | All barges carrying passengers except those covered by column 4. |

[1] Where length is used in this table it means the length measured from end to end over the deck, excluding sheer. This expression "means a straight line measurement of the overall length from the foremost part of the vessel to the aftermost part of the vessel, measured parallel to the centerline."

[2] Subchapters E (Load Lines), F (Marine Engineering), J (Electrical Engineering), and N (Dangerous Cargoes) of this chapter may also be applicable under certain conditions.

[3] Public nautical schoolships, other than vessels of the Navy and Coast Guard, shall meet the requirements of Part 167 of Subchapter R (Nautical Schools) of this chapter. Civilian nautical schoolships, as defined by 46 U.S.C. 1331, shall meet the requirements of Subchapter H (Passenger Vessels) and Part 168 of Subchapter R (Nautical Schools) of this chapter.

[4] Subchapter H (Passenger Vessels) of this chapter covers only those vessels of 100 gross tons or more. Subchapter T (Small Passenger Vessels) of this chapter covers only those vessels of less than 100 gross tons.

[5] Vessels covered by Subchapters H (Passenger Vessels) or I (Cargo and Miscellaneous Vessels) of this chapter, where the principal purpose or use of the vessel is not for the carriage of liquid cargo, may be granted a permit to carry a limited amount of flammable or combustible liquid cargo in bulk. The portion of the vessel used for the carriage of the flammable or combustible liquid cargo shall meet the requirements of Subchapter D (Tank Vessels) in addition to the requirements of Subchapter H (Passenger Vessels) or I (Cargo and Miscellaneous Vessels) of this chapter.

[6] Any vessel on an international voyage is subject to the requirements of the International Convention for Safety of Life at Sea, 1960.

[7] The meaning of the term "passenger" is as defined in the Act of May 10, 1956 (sec. 1, 70 Stat. 151; 46 U.S.C. 390).

[8] Boilers and machinery are subject to examination on vessels over 40 feet in length.

§ 70.05–15 Vessels subject to the act of May 10, 1956.

(a) The act of May 10, 1956 (46 U.S.C. 390–390g), applies to vessels which carry more than 6 passengers and which are:

(1) Mechanically propelled vessels of not more than 15 gross tons; or,

(2) Sailing vessels of not more than 700 gross tons; or,

(3) Nonself-propelled vessels of not more than 100 gross tons.

(b) Except as further set forth in this section, all vessels subject to the Act of May 10, 1956, shall meet all of the applicable requirements of this subchapter except that the Certificate of Inspection issued to the vessel shall be valid for a period of three years in lieu of one year, and reinspection will be made annually between inspections for certification.

(c) Vessels in existence as passenger vessels before June 1, 1958, and vessels contracted for as passenger vessels prior to June 1, 1958, which are subject to the act of May 10, 1956, shall meet the applicable requirements of this subchapter insofar as is reasonable and practicable in the opinion of the Officer in Charge, Marine Inspection. In this respect, he may grant departures from specific requirements of this subchapter if in his opinion the circumstances warrant such departure. In any case, the Officer in Charge, Marine Inspection, shall satisfy himself that the vessel and its equipment are in good condition and satisfactory for the purpose intended.

§ 70.05–20 Gross tonnage as a criterion for requirements.

(a) The regulations in this subchapter, as well as referenced requirements in other subchapters in this chapter, take into account the passenger vessel's size, construction, and equipment, as well as its intended service on the routes or waters on which it is desired to be operated or navigated, which are indications of the hazards to which such vessel may be subjected. The Commandant's determinations in this respect for a particular passenger vessel are stipulated in a certificate of inspection, which states certain terms and conditions governing such vessel when in operation.

(b) In applying the laws and regulations to passenger vessels, one criterion for invocation of safety standards is the description of passenger vessels by relative size in gross tons. When it is determined by the Commandant that the gross register tonnage for a particular passenger vessel, which is attained by exemptions, reductions, or other devices in the basic gross tonnage formulation, will circumvent or be incompatible with the application of specific safety requirements in the passenger vessel regulations for a vessel of such physical size, the Commandant shall prescribe the regulations to be made applicable to such vessel.

(c) When the Commandant determines that the gross register tonnage is not a valid criterion for the invocation of safety requirements based on relative size, the parties involved will be informed of the determination and of the regulations applicable to such passenger vessel, and before being permitted to operate such vessel, compliance therewith shall be required. Endorsements or notations on the passenger vessel's certificate of inspection may be made as appropriate.

§ 70.05–25 Portable containers—interpretive rulings.

(a) The phrase "drums, barrels, or other packages," as used in R.S. 4417a, as amended (46 U.S.C. 391a), and in R.S. 4472, as amended (46 U.S.C. 170), is interpreted to mean portable containers having a maximum capacity of 110 U.S. gallons and ICC specification cylinders having a water capacity of not more than 1,000 pounds, which are actually loaded and discharged from vessels with their contents intact.

(b) The phrase "inflammable or combustible liquid cargo in bulk" as used in R.S. 4417a, as amended (46 U.S.C. 391a), and in R.S. 4472, as amended (46 U.S.C. 170), is interpreted to include such cargo in portable containers of a capacity of more than 110 U.S. gallons.

(c) The phrase "liquid cargo" as used in R.S. 4417a, as amended (46 U.S.C. 391a), is interpreted to mean flammable or combustible liquids.

(Interpret or apply R.S. 4417a, as amended, 4472, as amended; 46 U.S.C. 391a, 170)

## Subpart 70.10—Definition of Terms Used in This Subchapter

§ 70.10–1 Approved.

This term means approved by the Commandant unless otherwise stated.

§ 70.10–2 Barge.

This term means any nonself-propelled vessel.

§ 70.10–3 Carrying passengers for hire.

The carriage of any person or persons by a vessel for a valuable consideration, whether directly or indirectly flowing to the owner, charterer, operator, agent or any other person interested in the vessel.

§ 70.10–5 Carrying freight for hire.

The carriage of any goods, wares, or merchandise or any other freight for a valuable consideration whether directly or indirectly flowing to the owner, charterer, operator, agent, or any other person interested in the vessel.

§ 70.10–7 Classed vessel.

This term means any vessel classed by the American Bureau of Shipping or other recognized classification society.

§ 70.10–9 Commandant.

This term means the Commandant of the Coast Guard.

§ 70.10–11 Coast Guard District Commander.

This term means an officer of the Coast Guard designated as such by the Commandant to command all Coast Guard activities within his district, which include the inspection, enforcement, and administration of Title 52, Revised Statutes, and acts amendatory thereof or supplemental thereto, and rules and regulations thereunder.

§ 70.10–13 Coastwise.

Under this designation shall be included all vessels normally navigating the waters of any ocean or the Gulf of Mexico 20 nautical miles or less offshore.

§ 70.10–15 Ferry.

Under this designation shall be included those vessels, in other than ocean or coastwise service, having provisions only for deck passengers and/or vehicles, operating on a short run on a frequent schedule between 2 points over the most direct water route, and offering a public service of a type normally attributed to a bridge or tunnel.

§ 70.10–17 Great Lakes.

Under this designation shall be included all vessels navigating the Great Lakes.

§ 70.10–19 Headquarters.

This term means the Office of the Commandant, United States Coast Guard, Washington, D.C., 20226.

§ 70.10–21 International voyage.

(a) The term "international voyage" as used in this subchapter shall have the same meaning as that contained in Regulation 2(d), Chapter I of the International Convention for Safety of Life at Sea, 1960, i.e., " 'International voyage' means a voyage from a country to which the present Convention applies to a port outside such country, or conversely; and for this purpose every territory for the international relations of which a Contracting Government is responsible or for which the United Nations is the administering authority is regarded as a separate country."

(b) The International Convention for Safety of Life at Sea, 1960, does not apply to vessels "solely navigating the Great Lakes of North American and the River St. Lawrence as far east as a straight line drawn from Cap de Rosiers to West Point, Anticosti Island and, on the north side of Anticosti Island, the 63d Meridian." Accordingly, such vessels shall not be considered as being on an "international voyage" for the purpose of this subchapter.

(c) For the purposes of this subchapter the term "territory" as used in paragraph (a) of this section shall be considered to include the Commonwealth of Puerto Rico, the Canal Zone, all possessions of the United States, and all lands held by the United States under a protectorate or mandate.

(d) In addition, although voyages between the continental United States and Hawaii or Alaska, and voyages between Hawaii and Alaska are not "international voyages" under the provisions of the International Convention for Safety of Life at Sea, 1960, such voyages are similar in nature and shall be considered as "international voyages" and subject to the same requirements for the purposes of this subchapter.

§ 70.10–23 Lakes, bays, and sounds.

Under this designation shall be included all vessels navigating the waters of any of the lakes, bays, or sounds other than the waters of the Great Lakes.

§ 70.10–25 Marine inspector or inspector.

These terms mean any person from the civilian or military branch of the Coast Guard assigned under the superintendence and direction of an Officer in Charge, Marine Inspection, or any other person as may be designated for the performance of duties with respect to the inspection, enforcement, and administration of Title 52, Revised Statutes, and acts amendatory thereof or supplemental thereto, and rules and regulations thereunder.

§ 70.10–29 Motor vessel.

This term means any vessel more than 65 feet in length, which is propelled by machinery other than steam.

§ 70.10–30 Nuclear vessel.

(a) A nuclear vessel is a vessel provided with a nuclear powerplant for propulsion or any other purpose, or any vessel handling or processing substantial amounts of radioactive material other than as cargo.

§ 70.10–31 Ocean.

Under this designation shall be included all vessels navigating the waters of any ocean or the Gulf of Mexico more than 20 nautical miles offshore.

§ 70.10–33 Officer in Charge, Marine Inspection.

This term means any person from the civilian or military branch of the Coast Guard designated as such by the Commandant and who, under the superintendence and direction of the Coast Guard District Commander, is in charge of an inspection zone for the performance of duties with respect to the inspections, enforcement, and administration of Title 52, Revised Statutes, and acts amendatory thereof or supplemental thereto, and rules and regulations thereunder.

§ 70.10–35 Passenger.

A passenger is every person other than the master and the members of the crew or other persons employed or engaged in any capacity on board a vessel in the business of that vessel. The following special considerations should be noted:

(a) In the case of a vessel on an international voyage a child under one year of age is not counted as a passenger.

(b) For vessels subject to the provisions of the act of May 10, 1956, the term "passenger" means every person carried on board a vessel other than:

(1) The owner or his representative;

(2) The master and the bona fide members of the crew engaged in the business of the vessel who have contributed no consideration for their carriage and who are paid for their services;

(3) Any employee of the owner of the vessel engaged in the business of the owner, except when the vessel is operating under a bareboat charter;

(4) Any employee of the bareboat charterer of the vessel engaged in the business of the bareboat charterer;

(5) Any guest on board a vessel which is being used exclusively for pleasure purposes who has not contributed any consideration directly or indirectly, for his carriage; or,

(6) Any person on board a vessel documented and used for tugboat or towboat service of fifty gross tons or more who has not contributed any consideration, directly or indirectly, for his carriage.

§ 70.10–37 Rules of the Road.

(a) The term "Rules of the Road" means the statutory and regulatory rules governing navigation of vessels. These rules are also published by the Coast Guard in pamphlet form as follows:

(1) Rules of the Road—International—Inland (CG–169).

(2) Rules of the Road—Great Lakes (CG–172).

(3) Rules of the Road—Western Rivers (CG–184).

(b) The current editions of the "Rules of the Road" pamphlets may be obtained from any Marine Inspection Office.

§ 70.10–39 Rivers.

Under this designation shall be included all vessels whose navigation is restricted to rivers and/or canals exclusively, and to such other waters as may be so designated by the Coast Guard District Commanders.

§ 70.10–41 Recognized classification society.

The term "recognized classification society" means the American Bureau of Shipping or other classification society recognized by the Commandant.

§ 70.10–42 Sailing vessel.

This term means a vessel with no mechanical means of propulsion, all propulsive power being provided by sails.

§ 70.10–43 Short international voyage.

For the purpose of this subchapter, the expression "short international voyage" means an international voyage in the course of which a vessel is not more than 200 miles from a port or place in which the passengers and crew could be placed in safety, and which does not exceed 600 miles in length between the last port of call in the country in which the voyage begins and the final port of destination.

§ 70.10–45 Vessel.

Where the word "vessel" is used in this subchapter, it shall be considered to include all vessels indicated in Column 4 of Table 70.05–1(a), which are of more than 65 feet in length measured from end to end over the deck excluding sheer, except as otherwise noted in this subpart.

§ 70.10–47 Western rivers.

For the purposes of this subchapter, the term "western rivers" is as defined in CG–184, "Rules of the Road—Western Rivers."

## Subpart 70.15—Equivalents

§ 70.15–1 Conditions under which equivalents may be used.

(a) Where in this subchapter it is provided that a particular fitting, material, appliance, apparatus, or equipment, or type thereof, shall be fitted or carried in a vessel, or that any particular provision shall be made or arrangement shall be adopted, the Commandant may accept in substitution therefor any other fitting, material, apparatus, or equipment, or type thereof, or any other provision or arrangement: *Provided*, That he shall have been satisfied by suitable trials that the fitting, material, appliance, apparatus, or equipment, or type thereof, or the provision or arrangement shall be at least as effective as that specified in this subchapter.

(b) In any case where it is shown to the satisfaction of the Commandant that the use of any particular equipment, apparatus, or arrangement not specifically required by law is unreasonable or impracticable, the Commandant may permit the use of alternate equipment, apparatus, or arrangement to such an extent and upon such conditions as will insure, to his satisfaction, a degree of safety consistent with the minimum standards set forth in this subchapter.

## Subpart 70.20—General Marine Engineering Requirements

§ 70.20–1 Marine engineering details.

All marine engineering details such as piping, valves, fittings, boilers, pressure vessels, etc., and their appurtenances installed on the vessel, shall be designed, constructed, and installed in accordance with the provisions of Subchapter F (Marine Engineering) of this chapter.

(R.S. 4418, as amended, 4433, as amended; 46 U.S.C. 392, 411)

§ 70.20–5 Nuclear vessels.

(a) Nuclear vessels shall comply with the applicable requirements in Subpart 57.30 of Part 57 of Subchapter F (Marine Engineering) of this chapter. The regulations covering the transportation and handling of radioactive materials as cargo are contained in Part 146 of Subchapter N (Dangerous Cargoes) of this chapter.

(R.S. 4417, as amended, 4418, as amended, 4472, as amended, sec. 2, 23 Stat. 118, as amended, secs. 2, 633, 63 Stat. 496, 545; 46 U.S.C. 391, 392, 170, 2, 14 U.S.C. 2, 633. Treasury Department Order 167–17, June 29, 1955, 20 F.R. 4976)

## Subpart 70.25—General Electrical Engineering Requirements

§ 70.25–1 Electrical engineering details.

All electrical engineering details and installations shall be designed and in-

stalled in accordance with Subchapter J (Electrical Engineering) of this chapter.

(R.S. 4418, as amended; 46 U.S.C. 392)

## Subpart 70.30—Special Provisions

### § 70.30–1 Vessels acquired or documented under the Act of August 9, 1954.

(a) Vessels acquired or documented under the act of August 9, 1954 (sec. 3, 68 Stat. 675; 50 U.S.C. 198), shall be subject to the applicable provisions of Title 52 of the Revised Statutes, acts amendatory thereof or supplemental thereto and the rules and regulations thereunder.

(b) Unapproved lifesaving, firefighting, and other equipment may be continued in service as long as, in the opinion of the Officer in Charge, Marine Inspection, such equipment is in good and serviceable condition. All replacements shall be in accordance with Coast Guard requirements.

### § 70.30–5 Installations of equipment made during the unlimited national emergency declared by the President on May 27, 1941.

(a) Boilers, pressure vessels, machinery, piping, electrical, and other installations, including lifesaving, firefighting, and other safety equipment, installed on vessels during the Unlimited National Emergency declared by the President on May 27, 1941, and prior to the determination of Title V of the Second War Powers Act, as extended (sec. 501, 56 Stat. 180, 50 U.S.C. App. 635), which do not fully meet the detailed requirements of the regulations in this chapter, may be continued in service if found to be satisfactory by the Commandant for the purpose intended.

## Subpart 70.35—American Bureau of Shipping's Standards

AUTHORITY: The provisions of this Subpart 70.35 interpret or apply sec. 25, 41 Stat. 9938, as amended, sec. 5, 49 Stat. 1384, as amended; 46 U.S.C. 881, 369.

### § 70.35–1 Standards to be used.

(a) Where in this subchapter an item, or method of construction, or testing is required to meet the standards established by the American Bureau of Shipping, the current standards in effect at the time of construction of the vessel, or otherwise as applicable, shall be used. The current standards of other recognized classification societies may also be accepted upon approval by the Commandant.

### § 70.35–5 Where obtainable.

(a) The standards established by the American Bureau of Shipping are usually published annually and may be purchased from the American Bureau of Shipping, 45 Broad Street, New York, N.Y., 10004. These standards may be also examined at the office of the Commandant (M), U.S. Coast Guard, Washington, D.C., 20226, or at the office of any Coast Guard District Commander or Officer in Charge, Marine Inspection.

# PART 71—INSPECTION AND CERTIFICATION

Subpart 71.01—Certificate of Inspection

Sec.
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71.47–1 When made.
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71.47–70 Responsibility of ship's officer for inspection of cargo gear.
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Subpart 71.50—Drydocking

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Subpart 71.55—Repairs and Alterations

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Subpart 71.60—Special Operating Requirements

71.60–1 Inspection and testing required when making alterations, repairs, or other such operations involving riveting, welding, burning or like fire-producing actions.

Subpart 71.65—Plan Approval

71.65–1 General.
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71.75–1 Application.
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71.75–15 Posting of Convention certificates.
71.75–20 Duration of certificates.

AUTHORITY: The provisions of this Part 71 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4418, as amended, 4421, as amended, 4426, as amended, 4433, as amended, 4453, as amended, 4488, as amended, 4490, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, sec. 5, 49 Stat. 1384, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 392, 399, 404, 411, 435, 481, 482, 489, 366, 395, 363, 369, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857, unless otherwise noted.

## Subpart 71.01—Certificate of Inspection

AUTHORITY: The provisions of this Subpart 71.01 interpret or apply R.S. 4423, as amended, sec. 12, 35 Stat. 428, as amended; 46 U.S.C. 400, 397.

### § 71.01–1 When required.

(a) Except as noted in this subpart or Subpart 71.05, no vessel subject to inspection and certification shall be operated without a valid certificate of inspection.

### § 71.01–5 Posting.

(a) On vessels of over 25 gross tons, the original certificate of inspection shall, in general, be framed under glass and posted in a conspicuous place where it will be most likely to be observed by the passengers. On vessels not over 25 gross

tons, and on other vessels such as barges, where the framing of the certificate under glass would be impracticable, the original certificate of inspection shall be kept on board to be shown on demand.

**§ 71.01–10 Period of validity.**

(a) Certificates of inspection will be issued for a period of one year, except for those vessels subject only to the act of May 10, 1956 (46 U.S.C. 390–390g), when the certificates will be issued for a period of three years. Application may be made by the owner for inspection and issuance of a new certificate of inspection at any time within its period of validity.

(b) The certificate of inspection may be revoked or suspended at any time.

**§ 71.01–15 Temporary certificate.**

(a) If necessary to prevent delay of the vessel, a temporary certificate of inspection, Form CG–854, shall be issued pending the issuance and delivery of the regular certificate of inspection. Such temporary certificate shall be carried in the same manner as the regular certificate and shall in all ways be considered the same as the regular certificate of inspection which it represents.

**§ 71.01–20 Expired certificate.**

(a) Nothing in this subpart shall prevent a vessel upon a regularly established line from a port in the United States to a port of a foreign country not contiguous to the United States whose certificate of inspection expires at sea or while said vessel is in a foreign port or a port of Hawaii from lawfully completing her voyage without the valid certificate of inspection or temporary certificate required by this subpart: *Provided*, That the voyage shall be completed within 30 days after the expiration of the certificate of inspection. No such vessel shall depart if its certificate of inspection will expire within 15 days of the date of sailing.

## Subpart 71.05—Permit To Proceed to Another Port for Repair

**§ 71.05–1 When issued.**

(a) The Officer in Charge, Marine Inspection, may issue a permit to proceed to another port for repair, Form CG–948, to a vessel, if in his judgment it can be done with safety, even if the certificate of inspection of the vessel has expired or is about to expire.

**§ 71.05–5 To whom issued.**

(a) Such permit will only be issued upon the written application of the master, owner, or agent of the vessel.

**§ 71.05–10 Conditions of permit.**

(a) The permit will state upon its face the conditions under which it is issued and whether or not the vessel is permitted to carry freight or passengers. Passengers may not be carried if the certificate of inspection has expired, except as provided under § 71.01–20.

**§ 71.05–15 Posting.**

(a) The permit shall be carried in a manner similar to that described in § 71.01–5 for a certificate of inspection.

## Subpart 71.10—Permit To Engage in Excursions

AUTHORITY: The provisions of this Subpart 71.10 interpret or apply R.S. 4466, as amended; 46 U.S.C. 453.

**§ 71.10–1 When issued.**

(a) The Officer in Charge, Marine Inspection, may issue a permit to carry additional passengers on an excursion, Form CG–949, if after personally inspecting the vessel, it can, in his judgment, be done with safety.

**§ 71.10–5 To whom issued.**

(a) Such permit will only be issued upon the written application of the master, owner, or agent of the vessel.

**§ 71.10–10 Conditions of permit.**

(a) The permit will state upon its face the conditions under which it is issued, the number of extra passengers the vessel may carry, any additional lifesaving or safety equipment which will be required, the route for which the permit is granted, and the dates on which the permit will be valid.

**§ 71.10–15 Posting.**

(a) The permit when used, shall be carried in addition to the certificate of inspection and shall be carried in a manner similar to that described in § 71.01–5 for a certificate of inspection.

## Subpart 71.15—Inspection of Vessels

**§ 71.15–1 Standards in inspection of hulls, boilers, and machinery.**

(a) In the inspection of hulls, boilers, and machinery of vessels, the standards established by the American Bureau of Shipping, see Subpart 70.35 of this subchapter respecting material and inspection of hulls, boilers, and machinery, and the certificate of classification referring thereto, except where otherwise provided for by the rules and regulations in this subchapter, Subchapter E (Load Lines), Subchapter F (Marine Engineering), or Subchapter J (Electrical Engineering) of this chapter, shall be accepted as standard by the inspectors.

## Subpart 71.20—Initial Inspection

**§ 71.20–1 Prerequisite of certificate of inspection.**

(a) The initial inspection is a prerequisite of the issuance of the original certificate of inspection.

**§ 71.20–5 When made.**

(a) The original inspection will only be made upon the written application of the owner or builder of the vessel to the Officer in Charge, Marine Inspection, on Form CG–3752, application for inspection of U.S. vessel, at or nearest the port where the vessel is located.

**§ 71.20–10 Plans.**

(a) Before application for inspection is made and before construction is started, the owner or builder shall have plans indicating the proposed arrangement and construction of the vessel approved by the Commandant. The procedure for submitting plans and the list of plans to be supplied is set forth in Subpart 71.65.

**§ 71.20–15 Scope of inspections.**

(a) The initial inspection, which may consist of a series of inspections during the construction of a vessel, shall include a complete inspection of the structure, machinery, and equipment, including the outside of the vessel's bottom, and the inside and outside of the boilers. The inspection shall be such as to insure that the arrangements, materials, and scantlings of the structure, boilers and other pressure vessels and their appurtenances, piping, main and auxiliary machinery, electrical installations, lifesaving appliances, fire-detecting and extinguishing equipment, pilot ladders, and other equipment fully comply with the applicable regulations for such vessel and are in accordance with approved plans, and that the radio installations, including fixed and portable radios for lifeboats, are in accordance with the requirements of the Federal Communications Commission. The inspection shall also be such as to insure that the workmanship of all parts of the vessel and its equipment is in all respects satisfactory and that the vessel is provided with lights, means of making sound signals and distress signals as required by applicable regulations and the applicable "Rules of the Road."

(b) For nuclear vessels, the foregoing inspections shall be made except insofar as they may be limited by the presence of radiation. In addition, the inspection shall include any special requirements of the vessel's "Safety Assessment."

**§ 71.20–20 Specific tests and inspections.**

(a) The applicable tests and inspections relating to annual inspection as set forth in Subpart 71.25 shall be made at this time. In addition, the following specific tests and inspections shall be made by the inspector:

(1) Installation of lifeboats, davits, and winches, see Subpart 75.35 of this subchapter.

(2) Installation of carbon dioxide extinguishing piping, see § 76.15–15 of this subchapter.

(3) For inspection procedures of marine engineering equipment and systems, see Subchapter F (Marine Engineering) of this chapter.

(4) For inspection procedures of electrical engineering equipment and systems, see Subchapter J (Electrical Engineering) of this chapter.

(5) For inspection and testing standards of structural subdivision integrity, see § 72.01–25 of this subchapter.

(6) For inspection and testing of watertight doors, see § 73.35–30 of this subchapter.

## Subpart 71.25—Annual Inspection

**§ 71.25–1 Prerequisite of reissuance of certificate of inspection.**

(a) The annual inspection is a prerequisite of the reissuance of a certificate of inspection.

**§ 71.25–5 When made.**

(a) The annual inspection will be made only upon the written application of the

master, owner, or agent of the vessel on Form CG–3752, Application for Inspection of U.S. Vessel, to the Officer in Charge, Marine Inspection, at or nearest the port where the vessel is to be inspected.

**§ 71.25–10 Scope of inspections.**

(a) The annual inspection shall include an inspection of the structure, boilers, and other pressure vessels, machinery and equipment. The inspection shall be such as to insure that the vessel, as regards the structure, boilers and other pressure vessels, and their appurtenances, piping, main and auxiliary machinery, electrical installations, lifesaving appliances, fire-detecting and extinguishing equipment, pilot ladders, and other equipment is in satisfactory condition and fit for the service for which it is intended, and that it complies with the applicable regulations for such vessels, and that the radio installations, including fixed and portable radios for lifeboats, are in compliance with the requirements of the Federal Communications Commission. The lights and means of making sound signals and the distress signals carried by the vessel shall also be subject to the above-mentioned annual inspection for the purpose of insuring that they comply with the requirements of the applicable regulations and the applicable "Rules of the Road."

(b) For nuclear vessels, the foregoing inspections shall be made except insofar as they may be limited by the presence of radiation. In addition, the inspection shall include any special requirements of the vessel's "Safety Assessment."

**§ 71.25–15 Lifesaving equipment.**

(a) At each annual inspection, the inspector shall conduct the following tests and inspections of lifesaving equipment:

(1) It shall be demonstrated that the air tanks of all lifesaving appliances are airtight.

(2) Each lifeboat shall be lowered to near the water and then be loaded with its allowed capacity, evenly distributed throughout the length and then be lowered into the water until it is afloat and be released from the falls: *Provided,* That lifeboats on river ferryboats and on river vessels shall be lowered to the water and afloat before loading. In making this test persons or deadweight may be used. The total weight used shall be at least equal to the allowed capacity of the lifeboat, considering persons to weigh 165 pounds each.

(3) Each life preserver or wood float shall be examined to determine its serviceability. If found to be satisfactory, it will be stamped "Passed," together with the date, the port, and the inspector's initials. If not in a serviceable condition, the life preserver or wood float shall be removed from the vessel. If the life preserver is beyond repair, it shall be destroyed in the presence of the inspector.

(4) All lifeboat winch electrical control apparatus shall be opened up and inspected.

(5) Where gravity davits are installed, it shall be demonstrated that each lifeboat can be swung out and lowered from any stopped position by merely releasing the brake on the lifeboat winch. The use of force to start the davits or the lifeboat winch will not be permitted.

(6) Inflatable liferafts shall be serviced at an approved servicing facility in accordance with Subpart 160.051 of Subchapter Q (Specifications) of this chapter. Inflatable liferafts shall be serviced at an approved servicing facility every 12 months or not later than the next vessel inspection for certification provided the total time since date of last servicing does not exceed 15 months. The period for servicing is computed from date of last servicing. Except in emergencies no servicing should be done aboard vessels. If at any time external damage is found to the container or straps or if the seal is broken, the Officer in Charge, Marine Inspection, shall be notified and the raft shall be serviced by an approved servicing facility.

NOTE: After the raft has been satisfactorily serviced in the presence of a marine inspector at an approved servicing facility, the raft is repacked and sealed and the carrying case stamped "PASSED" together with the date, port, and the inspector's initials.

(7) Where launching devices for inflatable liferafts are installed, the launching device shall be proof tested with a weight equal to the raft and its full complement of persons and equipment.

(8) All other items of lifesaving equipment shall be examined to determine that they are in suitable condition.

**§ 71.25–20 Fire-detecting and extinguishing equipment.**

(a) At each annual inspection, the inspector shall conduct the following tests and inspections of fire detecting and extinguishing equipment:

(1) All hand portable fire extinguishers and semiportable fire extinguishing systems shall be checked as noted in Table 71.25–20 (a) (1). In addition, the hand portable fire extinguishers and semiportable fire extinguishing systems shall be examined for excessive corrosion and general condition.

TABLE 71.25–20(a)(1)

| Type unit | Test |
|---|---|
| Soda acid | Discharge. Clean hose and inside of extinguisher thoroughly. Recharge. |
| Foam | Discharge. Clean hose and inside of extinguisher thoroughly. Recharge. |
| Pump tank (water or antifreeze). | Discharge. Clean hose and inside of extinguisher thoroughly. Recharge with clean water or antifreeze. |
| Cartridge operated (water, antifreeze or loaded stream). | Examine pressure cartridge and replace if end is punctured or if cartridge is otherwise determined to have leaked or to be in unsuitable condition. Remove liquid. Clean hose and inside of extinguisher thoroughly. Recharge with clean water, solution or antifreeze. Insert charged cartridge. |
| Carbon dioxide | Weigh cylinders. Recharge if weight loss exceeds 10 percent of weight of charge. Inspect hose and nozzle to be sure they are clear.[1] |
| Dry chemical (cartridge-operated type). | Examine pressure cartridge and replace if end is punctured or if cartridge is otherwise determined to have leaked or to be in unsuitable condition. Inspect hose and nozzle to see they are clear. Insert charged cartridge. Be sure dry chemical is free-flowing (not caked) and chamber contains full charge. |
| Dry chemical (stored pressure type). | See that pressure gage is in operating range. If not, or if seal is broken, weigh or otherwise determine that full charge of dry chemical is in extinguisher. Recharge if pressure is low or if dry chemical is needed. |
| Vaporizing liquid[2] (pump type). | Pump a few strokes into clean pail and replace liquid. Keep water out of extinguisher or liquid. Keep extinguisher completely full of liquid. |
| Vaporizing liquid[2] (stored pressure type). | See that pressure gage is in operating range. Weigh or check liquid level to determine that full charge of liquid is in extinguisher. Recharge if pressure is low or if liquid is needed. |

[1] Cylinders shall be tested and marked in accordance with the regulations of the Interstate Commerce Commission, as noted in § 147.04–1 of Subchapter N (Dangerous Cargoes) of this chapter.

[2] Vaporizing-liquid type fire extinguishers containing carbon tetrachloride or chlorobromomethane or other toxic vaporizing liquids shall be removed from all vessels. (See § 76.50–5(c) of this subchapter.)

(2) Fixed fire extinguishing systems shall be checked as noted in Table 71.25–20 (a) (2). In addition all parts of the fixed fire extinguishing systems shall be examined for excessive corrosion and general conditions.

TABLE 71.25–20 (a) (2)

| Type system | Test |
|---|---|
| Foam | Systems utilizing a soda solution shall have such solution replaced. In all cases, ascertain that powder is not caked. |
| Carbon dioxide | Weigh cylinders. Recharge if weight loss exceeds 10 percent of weight of charge.[1] |

[1] Cylinders shall be tested and marked in accordance with the regulations of the Interstate Commerce Commission, as noted in § 147.04–1 of Subchapter N (Dangerous Cargoes) of this chapter.

(3) All fire detecting and extinguishing systems, all piping controls, valves, and alarms shall be checked to ascertain that the system is in operating condition. In this respect, automatic sprinkling systems shall be checked by means of test stations or opening heads, smoke detecting systems shall be checked by introducing smoke into the accumulators, fire detecting and manual alarm systems shall be checked by test stations or actuating detectors or pull boxes, and steam smothering lines shall be checked with at least a 50 p. s. i. air pressure with the ends capped or by blowing steam through the lines at the designed pressure.

(4) The fire main system shall be operated and the pressure checked at the most remote and highest outlets. All fire hose shall be subjected to a test pressure equivalent to the maximum pressure to which they may be subjected in service, but not less than 100 p. s. i.

**§ 71.25–25 Hull equipment.**

(a) At each annual inspection, the inspector shall conduct the following tests and inspections of hull equipment:

(1) All subdivision bulkheads shall be examined to determine that their watertight integrity has not been impaired.

(2) All watertight doors shall be operated locally by manual power and also by hydraulic or electric power if so fitted. Where remote control is fitted, the doors shall also be operated by the remote control apparatus.

(3) All magnetically controlled fire doors shall be operated locally and by the remote control, and all automatic fire dampers shall be checked to determine that they are in an operable condition.

(4) The remote controls of all valves shall be operated.

(5) An inspection of the cargo gear shall be required. The inspection may consist of tests and examinations to determine the condition and suitability of the cargo gear. Current valid certificates and registers of cargo gear issued by nonprofit organizations or associations approved by the Commandant, may be accepted as prima facie evidence of the condition and suitability of the cargo gear. Cargo gear certificates and registers will not be issued by the Coast Guard.

(b) Every acceptable cargo gear certificate and/or register shall be properly executed by a person authorized to do so and shall:

(1) Certify as to the tests and examinations conducted;

(2) Show the dates on which the tests and examinations were conducted; and,

(3) Indicate that the cargo gear therein described complies with standards equal to or exceeding those set forth in Subpart 71.47.

(c) Competent persons for the purposes of this section and Subpart 71.47 are:

(1) Coast Guard marine inspectors;

(2) Surveyors of the organizations or associations approved by the Commandant;

(3) Such other persons as are authorized by the regulations in Subpart 71.47 as may be required; and,

(4) Responsible officials or employees of the testing laboratories, companies, or organizations who conduct tests of pieces of loose cargo gear, wire rope, or the annealing of gear as may be required.

(d) The registers issued in connection with cargo gear certification must have all required entries fully completed as of the dates indicated, shall be kept current, and shall include the following:

(1) A register of the cargo handling machinery and the gear accessory thereto carried on the vessel named therein;

(2) Certification of the testing and examination of winches, derricks, and their accessory gear;

(3) Certification of the testing and examination of cranes, hoists, and their accessory gear;

(4) Certification of the testing and examination of chains, rings, hooks, shackles, swivels, and blocks;

(5) Certification of the testing and examination of wire rope;

(6) Certification of the heat treatment of chains, rings, hooks, shackles, and swivels which require such treatment; and,

(7) Certification of the annual thorough examinations of gear not required to be periodically heat treated.

(e) It is the responsibility of the master to have a ship's officer inspect cargo gear when required by Subpart 71.47. For those inspected vessels which do not have valid cargo gear certificates and registers as provided by this section, such vessels will be required to have their shipboard cargo gear undergo tests and examinations in accordance with the provisions of Subpart 71.47.

**§ 71.25–30 Electrical engineering equipment.**

(a) For inspection procedures of electrical engineering equipment and systems, see subchapter J (Electrical Engineering) of this chapter.

**§ 71.25–35 Marine engineering equipment.**

(a) For inspection procedures of marine engineering equipment and systems, see Subchapter F. (Marine Engineering) of this chapter.

**§ 71.25–40 Sanitary inspection.**

(a) At each annual inspection the passenger and crew quarters, toilet and washing spaces, galleys, serving pantries, lockers, etc., shall be examined by the inspector to be assured that they are in a sanitary condition.

(Sec. 4, 49 Stat. 1935, as amended; 46 U.S.C. 660a)

**§ 71.25–45 Fire hazards.**

(a) At each annual inspection, the inspector shall examine the tank tops and bilges in the machinery spaces to see that there is no accumulation of oil which might create a fire hazard.

**§ 71.25–50 Inspector not limited.**

(a) Nothing in this subpart shall be construed as limiting the inspector from making such tests or inspections as he deems necessary to be assured of the safety and seaworthiness of the vessel.

## Subpart 71.30—Reinspection

**§ 71.30–1 When made.**

(a) In general, at least three reinspections shall be made on each vessel within one year. These reinspections will be made at approximately equal intervals between annual inspections. In the case of vessels with a seasonal schedule, reinspections will be made during the operating season if practicable.

(b) For those vessels subject only to the act of May 10, 1956 (46 U.S.C. 390–390g), reinspections will be made annually between inspections for certification.

**§ 71.30–5 Scope.**

(a) The inspector shall examine all accessible parts of the vessel's hull, machinery, and equipment to be assured that it is in a satisfactory condition.

(b) In general, the scope of the reinspection shall be the same as for the annual inspection, but will be in less detail unless it is determined that major change has occurred since the last annual inspection.

**§ 71.30–10 Inspector not limited.**

(a) Nothing in this subpart shall be construed as limiting the inspector from making such tests or inspections as he deems necessary to be assured of the safety and seaworthiness of the vessel.

## Subpart 71.40—Inspection After Accident

**§ 71.40–1 General or partial survey.**

(a) A survey, either general or partial, according to the circumstances, shall be made every time an accident occurs or a defect is discovered which affects the safety of the vessel or the efficacy or completeness of its lifesaving appliances, fire-fighting or other equipment, or whenever any important repairs or renewals are made. The survey shall be such as to insure that the necessary repairs or renewals have been effectively made, that the material and the workmanship of such repairs or renewals are in all respects satisfactory, and that the vessel complies in all respects with the regulations in this subchapter.

(R.S. 4450, as amended; 46 U.S.C. 239)

## Subpart 71.45—Sanitary Inspections

**§ 71.45–1 When made.**

(a) An inspection of passenger and crew quarters, toilet and washing spaces, serving pantries, galleys, etc., shall be made, in general, at least once in every month. If the route of the vessel is such that it is away from a United States port for more than one month, an inspection shall be conducted at least once every trip.

(Sec. 4, 49 Stat. 1935, as amended; 46 U.S.C. 660a)

## Subpart 71.47—Inspection of Cargo Gear

**§ 71.47–1 When made.**

(a) The specific tests and examinations shall be made at the intervals stated in the regulations in this subpart.

(b) A thorough examination of the assembled gear shall be made at least once in every year.

(c) An inspection to determine the condition and suitability of shipboard cargo gear will be made by a marine inspector at each inspection for certification. Inspections may be made at such other times as considered necessary by the Officer in Charge, Marine Inspection.

(d) For vessels fitted with cargo gear, an initial test of the assembled units under proof loads shall be conducted, followed by a complete dismantling or disassembling of such gear and a thorough examination of the parts to ascertain its condition. Subsequent tests of the assembled units under proof loads, followed by a dismantling or disassembling of such gear and a thorough examination shall be made once every 4 years, or oftener if necessary.

**§ 71.47–3 Definitions of terms and words used in this subpart.**

(a) *Cargo gear.* The term "cargo gear" includes masts, stays, booms, winches, cranes, elevators, conveyors, standing and running gear forming that part of the shipboard cargo gear used in connection with the loading or unloading of a vessel. This term does not include material handling gear and rigging of special design vessels used solely in dredging, pile driving, drilling for mineral deposits, and construction work.

(b) *Dismantling or disassembling of gear.* The "dismantling" or "disassembling" of gear contemplated is the taking apart of units of gear to the extent necessary to determine the suitability of such gear for continued service and as may be specifically required to carry out the intent of a particular regulation in this subpart. After proof load tests the disassembling need not include the sheaves and pins of the blocks included in the test unless there appears to be evidence of deformation or failure.

(c) *Thorough examination.* The "thorough examination" contemplated is a visual examination, supplemented if necessary by other means such as by a hammer test or by a test with electronic or ultrasonic devices.

(d) *Ton.* The word "ton" means a ton of 2,240 pounds.

(e) *Safe working load.* The "safe working load" (SWL) contemplated is the load the gear is approved to lift, excluding the weight of the gear itself.

**§ 71.47–5 Tests and examinations of shipboard cargo gear.**

(a) For vessels fitted with cargo gear and without valid cargo gear certificates and registers issued by organizations or associations, recognized by the Coast Guard, inspections shall be made by those competent persons described in § 71.25–25(c) (1) and (2), to determine the condition and suitability of the shipboard cargo gear. For the initial and subsequent quadrennial inspections, all the cranes, winches, hoists, derrick booms, derrick and mast bands, and all parts used in loading or unloading cargo shall be assembled in units and such assembled units shall then be tested under proof loads. The proof loads shall be handled for various types of units as required by specific regulations in this subpart. After the proof load tests of the assembled units of gear have been made, such gear shall be disassembled or dismantled so as to permit them to be thoroughly examined. The sheaves and pins of the blocks included in these proof load tests need not be removed unless there appears to be evidence of deformation or failure.

(b) For vessels fitted with cargo gear and holding valid cargo gear certificates and registers issued by organizations or associations recognized by the Coast Guard, the marine inspectors may accept such certificates as prima facie evidence of compliance with the requirements in this subpart. If an Officer in Charge, Marine Inspection, is in doubt as to the condition and suitability of shipboard cargo gear for such a vessel, the tests and examinations, or such portions thereof as deemed necessary, provided for in this subpart will be required.

(c) If any part or portion of the gear fails or becomes defective during such tests, such defective equipment shall be satisfactorily repaired or replaced.

**§ 71.47–10 Cargo gear of special design and limited use.**

(a) The regulations in this subpart shall apply to cargo gear of special design and limited use (derrick barges rigged for heavy lifts, cargo booms on self unloaders, etc.) only to the extent that it is practicable to do so. These requirements may be modified by the Officer in Charge, Marine Inspection, where the inspection is performed, according to the design characteristics of such cargo gear.

(b) Nondestructive tests, such as radiography, ultrasonic, electronic or other methods, may be utilized to determine the condition of heavy lift gear after it has been unit tested, provided such methods are acceptable to the Officer in Charge, Marine Inspection, having cognizance of the tests. However, no deviations or modifications shall be permitted to lessen the requirements for cargo gear inspection as set forth in § 71.47–70 and the maintenance of the applicable cargo gear records as set forth in § 71.47–75.

**§ 71.47–15 Cargo gear plans required when plans are not approved by a classification society.**

(a) For a new vessel or a vessel applying for initial inspection, the following plans of cargo gear shall be submitted in triplicate to the Officer in Charge, Marine Inspection, having jurisdiction for approval:

(1) Plans showing a stress diagram with the principal details of the gear.

(2) Plans containing a diagram showing the arrangement of the assembled gear and indicating the safe working load for each component part.

(b) The safe working load on which the design of any component part of the cargo gear is to be based, shall be taken as the maximum resultant load upon the component part in the design conditions assumed. The safe working load of the assembly is the load the gear is approved to lift, excluding the weight of the gear itself.

(c) One approved copy of each set of cargo gear plans shall be retained on the vessel.

**§ 71.47–20 Cargo gear plans approved by a classification society.**

(a) The plans required by § 71.47–15 (a) need not be submitted to the Officer in Charge, Marine Inspection, for approval if such plans are or have been approved by the American Bureau of Shipping or similar classification society recognized by the Commandant.

(b) One approved copy of each set of cargo gear plans shall be retained on the vessel.

**§ 71.47–25 Factors of safety.**

(a) In the design of the cargo gear, the safety factors in Table 71.47–25(a), taken in association with suitable design assumptions for actual loading conditions, shall be used and regarded as minima.

TABLE 71.47–25(a)

| Safe working loads for component parts | Safety factors based on— | | |
|---|---|---|---|
| | Ultimate strength | Yield point | Breaking test load |
| All metal structural parts, except steel booms: | | | |
| When the working load of the assembled gear is 10 tons or less | [1] 5 | ---------- | ---------- |
| When the working load of the assembled gear is 13 tons or over | [1] 4 | ---------- | ---------- |
| Steel booms: | | | |
| When the working load of the assembled gear is 10 tons or less | ---------- | [1] 3 | ---------- |
| When the working load of the assembled gear is 13 tons or over | ---------- | [1] 2½ | ---------- |
| Wooden structural parts | 8 | ---------- | ---------- |
| Chains | 4½ | ---------- | ---------- |
| Wire rope: | | | |
| For working loads 10 tons [1] or under | ---------- | ---------- | 5 |
| For working loads over 10 tons [1] | ---------- | ---------- | 4 |
| Fiber rope: | | | |
| When intended for running rigging | 7 | ---------- | ---------- |
| When intended for fixed gears and vangs | 5 | ---------- | ---------- |

[1] For working loads between 10 and 13 tons, intermediate values of safety factors may be used.

(b) The Commandant will give consideration to the use of factors of safety differing from those given in Table 71.47–25(a) where special materials or cargo gear of special design are to be used.

**§ 71.47–30 Loose gear certificates and tests.**

(a) (1) Evidence of compliance with the proof load test requirements in this section for all chains, rings, hooks, links, shackles, swivels, blocks, and any other loose gear whether accessory to a machine or not, but which is used as ship's cargo gear, shall be listed on an appropriate certificate.

(2) This evidence of test and the recording thereof is required only once with respect to each article of gear so long as each article is identified and the certificates required are available on the vessel.

(3) Proof loads applied to the articles of loose gear shall be as shown in Table 71.47–30(a)(3).

(b) All chains, rings, hooks, links, shackles, swivels, blocks, and any other loose gear whether accessory to a machine or not, but which is used or intended for use as ship's cargo gear, shall bear a mark or number by which each piece can be identified and shall be listed on a loose gear certificate. The safe working load "SWL" shall be marked on all blocks.

(c) The loose gear certificate shall show the distinguishing number or mark applied to the article of gear; a description of the article of gear; the date when the test proof load was applied; and the safe working load. The forms for loose gear certificates shall be as prescribed by and acceptable to associations or organizations approved by the Comman-

TABLE 71.47-30(a)(3)

| *Article of gear* | *Proof load* |
|---|---|
| Chains, rings, hooks, links, shackles, swivels | Twice the safe working load. |
| Single sheave block | Four times the safe working load.[1] |
| Multiple sheave block with safe working load up to and including 20 tons.[1] | Twice the safe working load. |
| Multiple sheave block with safe working load over 20 tons up to and including 40 tons. | 20 tons in excess of the safe working load. |
| Multiple sheave block over 40 tons | One and a half times the safe working load. |
| Roller chains (pitched chains) used with hand operated chain falls, and rings, hooks, shackles, or swivels permanently attached thereto. | Do. |
| Chain fall blocks used with roller chains (pitched chains), and rings, hooks, shackles, or swivels permanently attached thereto. | Do. |

[1] The proof load applied to the block is equivalent to twice the maximum resultant load on the eye or pin when lifting the safe working load attached to a rope which passes around the sheave of the block. The proof load is, therefore, equal to four times the safe working load or twice the safe working load when the load is attached directly to the block instead of a rope passing around the sheave.

dant and shall be suitable for the purposes of this section.

(d) After being tested all of the gear shall be examined to ascertain whether any part has been damaged, permanently deformed by the test or has other visible defects. The pins and sheaves of all tested blocks shall be removed for this purpose. If damaged during these tests, such gear shall be satisfactorily repaired or replaced.

(e) The required examinations as set forth in paragraph (d) of this section may be accomplished by mechanical, electrical, or other means provided the method employed is equal in efficiency to the visual examination of disassembled gear.

**§ 71.47-35 Test and certification of wire rope.**

(a) All wire rope used as shipboard cargo gear shall be able to withstand a breaking test load of at least five times the safe working load. In the case of gear with a lifting capacity of over 10 tons, the breaking test load of wire rope shall be at least four times the safe working load. All wire rope shall be identified and described in a wire rope certificate. Such certificate shall be furnished and attested to by the manufacturer or a testing agency and shall certify:

(1) The breaking test load of a sample of the wire rope, which should be at least five times the safe working load or at least four times the safe working load if part of gear with a lifting capacity of over 10 tons;

(2) The name and address of the manufacturer;

(3) The diameter of the rope in inches and/or fractions thereof;

(4) The number of strands and the number of wires in each strand;

(5) The quality of the wire (e.g. improved plow steel);

(6) The date of the test; and,

(7) The load at which the sample broke.

(b) The forms for the wire rope certificates shall be as prescribed by and acceptable to associations or organizations approved by the Commandant and shall be suitable for the purposes described in this section.

(c) In addition to the manufacturers' or testing agencies' attestations, a sample of the wire rope may be tested to destruction if required by the marine inspector when a visual inspection indicates an apparent defective condition.

**§ 71.47-40 Proof test of cargo gear as a unit.**

(a) Winches with their accessory gear, including the derricks and attachments, at least once in each four years, shall be tested as a unit with proof loads exceeding the safe working load as set forth in Table 71.47-40(a).

TABLE 71.47-40(a)

| *Safe working load of assembled gear* | *Proof load* |
|---|---|
| Not exceeding 20 tons | 25 percent in excess. |
| Over 20 tons but not exceeding 50 tons. | 5 tons in excess. |
| Over 50 tons | 10 percent in excess. |

(b) The proof load applied to winches and their gear shall be lifted with the ship's normal tackle, including the winches, and with the boom at an angle which should not be greater than 15 degrees to the horizontal or to the lowest angle approved in association with the design, or when these angles are impracticable to the lowest practicable angle. When the load has been lifted, it shall be swung as far as possible in both directions.

(1) Where electrical winches are fitted with electromagnetic brakes, or where electrohydraulic winches are fitted with electromagnetic or hydraulic brakes at the winch, mechanical brakes for manual operations will not be required, but if so fitted shall be in satisfactory operating condition.

(2) Current for electric winch operation during the test shall be taken from the ship's circuits. Shore current may be used if it passes through the ship's switchboard.

(c) Cranes and other hoisting machines with their accessory gear, at least once in each four years, shall be tested with a proof load which shall exceed the safe working load as set forth in Table 71.47-40(a).

(d) The proof load applied to cranes and hoists shall be lifted, topped and swung (slewed) as far as possible in each direction. If the boom of the crane has a movable radius, it shall be tested with a proof load as set forth in this section at the maximum and minimum radii of the boom. In the case of hydraulic cranes whose capacity is limited by pressure, and with which it is not possible to lift a load 25 percent in excess of the safe working load, the greatest possible load in excess of the safe working load, shall be used. These tests and the amounts of the loads shall be recorded.

(e) After satisfactory completion of the proof load testing of the cargo gear in accordance with paragraphs (a), (b), (c), and (d) of this section, the cargo gear and all component parts shall be given a thorough visual examination, supplemented as necessary by other means such as a hammer test or with electronic or ultrasonic devices, to determine if any of the parts were damaged, deformed, or otherwise rendered unsafe for further use. If found defective, such gear shall be replaced.

(1) When the test is being conducted for the first time on a vessel, accessory gear shall be dismantled or disassembled for examination after the test. The sheaves and pins of the blocks included in this test need not be removed unless there appears to be evidence of deformation or failure.

(2) For subsequent tests such parts of the machinery and gear shall be dismantled and/or disassembled after the test as necessary to determine its suitability for continued service.

(f) Appropriate means shall be provided to prevent the foot of the boom from being accidentally lifted from the socket during the test.

(g) Vessels whose cargo gear has been in use but are without the valid registers and certificates described in § 71.25-25 will be inspected for defective cargo gear. The gear shall then be tested and examined as prescribed in this section. If the movable weights for proof testing are not reasonably available, a spring or hydraulic scale certified for accuracy may be used. Whenever such scales are used, the proof load shall be applied with the boom swung out as far as possible in one direction and then in the other direction, and at such intermediate positions as may be indicated. At any position, the indicator of the scale must maintain a constant reading under the proof load for a period of five minutes.

(h) On all types of winches and cranes efficient means shall be provided to stop and hold the proof load in any position, and the efficiency of such means shall be demonstrated.

(1) Electric winches, electrohydraulic winches fitted with electromagnetic or hydraulic brakes at the winch, or cranes shall be equipped so that a failure of the electric power shall stop the motion and set the brakes without any action on the part of the operator.

(2) Current for electric winch and crane operations during the tests shall be taken from the ship's circuits. Shore current may be used if it passes through the ship's switchboard.

**§ 71.47–45 Marking of booms and cranes.**

(a) The safe working load (abbreviated "SWL") for the assembled gear shall be marked on the heel of each boom with the minimum angle to the horizontal for which the gear is designed. These letters and figures shall be in contrasting colors to the background and at least one inch in height.

(b) Where booms are rated at varying capacities depending on the radii, tables indicating the maximum safe working loads for the various working angles of the boom and the maximum and minimum radii at which the boom may be safely used shall be conspicuously posted near the controls and visible to the operator when working the gear.

**§ 71.47–50 Use of wire rope and chains.**

(a) An eye splice made in any wire rope used as cargo gear, with or without a thimble, shall have at least three tucks with whole strands and two tucks with one half of the wire cut from the tucking strand: *Provided,* That this requirement shall not preclude the use of any other form of splice or connection if it is as efficient as the splice specified.

(b) Single wire rope cargo falls, wire rope pendants, topping lifts and preventers shall consist of clear lengths without splices except at the working ends. Wire rope clips shall not be used to form eyes in the working ends of single wire rope cargo falls.

(c) Wire rope shall not be used for shipboard cargo gear if in any length of 8 diameters, the number of broken wires exceeds ten percent of the total number of wires in the rope, or if the rope shows other signs of excessive wear, corrosion, kinking or defect.

(d) Hoisting or sling chains used for shipboard cargo gear shall not be used if a length of chain has been stretched more than five percent of the original length, or the chain has become unsafe through overloading or faulty heat treatment, or whenever other external defects are evident.

(e) Chains used for shipboard cargo gear shall not be shortened by knotting, bolting, or wiring the links. The use of chains having a knot or kink as shipboard cargo gear is prohibited.

**§ 71.47–55 Annealing.**

(a) Chains, hooks, rings, links, shackles, and swivels of wrought iron used as cargo gear shall be annealed at the following intervals:

(1) Wrought iron chains and gear in general use and of one half inch or less, once at least in every six months.

(2) All other wrought iron chains and gear, including topping lift chains, in general use, at least once in every twelve months.

(b) The annealing shall be done in a suitable closed oven and not over an open fire. Wrought iron shall be annealed at a temperature of between 1100° and 1200° Fahrenheit for a period of between 30 and 60 minutes. After being annealed, the article shall be allowed to cool slowly and shall be then tested completely for defects.

(c) Heat treatment of the cargo gear shall be done only by reputable firms having suitable equipment and personnel trained for this purpose. A certificate attesting to the annealing of all gear heat treated shall be furnished to the vessel.

(d) The heat treatment of chains, hooks, rings, links, shackles, and swivels of materials other than wrought iron used as cargo gear, if required, shall be effected in accordance with the manufacturer's instructions.

**§ 71.47–60 Additions to gear.**

(a) When articles of loose gear and/or wire rope conforming with the requirements in this subpart are added to installed gear, or used as replacements in such gear from time to time, a record shall be maintained on the vessel which shall identify each article and the certificate accompanying it.

**§ 71.47–65 Alterations, renewals, or repairs of cargo gear.**

(a) Whenever important repairs, renewals, or alterations are indicated or intended for the masts, booms, and permanent fittings of the cargo gear, such repairs, renewals, or alterations shall be undertaken only after compliance with the applicable provisions of § 71.55–1.

(b) Tests and examinations of the repairs, renewals, or alterations will be in accordance with the provisions of § 71.47–40.

(c) When welding is used to lengthen, alter, or repair chains, rings, hooks, links, shackles, or swivels, they shall be properly heat treated and shall before being again put into use, be tested and examined in accordance with the provisions of § 71.47–30.

**§ 71.47–70 Responsibility of ship's officer for inspection of cargo gear.**

(a) All wire rope, chains other than bridle chains attached to booms or masts, and all rings, hooks, links, shackles, swivels and blocks used in loading or unloading shall be visually inspected by a ship's officer designated for that purpose by the master.

(b) These inspections by a ship's officer shall be made at frequent intervals, and in any event not less than once in each month.

(c) Immediately after such an inspection by a ship's officer notations of such an inspection shall be made in record form which shall be in or kept with the cargo gear register if carried. In addition, the same notations of inspections together with the dates shall be entered in the Official Logbook for those vessels required to carry this record, or such information shall be kept with the log records maintained on vessels not required to carry the Official Logbook. (See § 71.47–75 for entries required to be kept.)

**§ 71.47–75 Records regarding cargo gear.**

(a) The cargo gear records described in this subpart shall be maintained on the vessel and shall be made available to Coast Guard officials upon request. These records shall be kept for the periods of time they are valid and, in addition, until the next Coast Guard inspection for certification of the vessel. The certificates of manufacturers and/or testing laboratories, companies, or organizations shall be maintained on the vessel so long as the gear described in such certificates is on board the vessel.

(b) The records of all the inspections of cargo gear made by the ship's officers in accordance with § 71.47–70 shall be maintained on the vessel for periods of time which agree with those periods as covered by the current Coast Guard certificate of inspection issued to the vessel. These records shall show the dates of inspections, identify articles inspected, the conditions observed, and the name of the officer performing the inspection.

(c) The records of all tests and examinations conducted by or under the supervision of surveyors of the organizations or associations approved by the Commandant shall be maintained on the vessel.

(d) The Coast Guard will not issue cargo gear certificates and/or registers. The Coast Guard's records of inspections, tests, and examinations of a particular vessel's cargo gear made by a marine inspector or conducted under the supervision of the Coast Guard will be maintained in the office of the Officer in Charge, Marine Inspection, having jurisdiction over the vessel at the time such work was performed. The original certificates or certified copies of certificates of manufacturers and/or testing laboratories, companies, or organizations for loose cargo gear, wire rope, or the annealing of gear shall be maintained on the vessel.

**§ 71.47–80 Advance notice that cargo gear testing is desired.**

(a) The owner, agent, or master of a vessel shall give an advance notice when it is desired that the tests and examinations of cargo gear be made by or under the supervision of the marine inspector. This advance notice shall be given to the Officer in Charge, Marine Inspection, in whose marine inspection zone the vessel is available for such inspection and examination.

(b) For the initial inspection and examination of cargo gear by the Coast Guard, the advance notice shall be to the cognizant Officer in Charge, Marine Inspection, as early as possible and shall include sketches and/or drawings showing each unit of cargo gear, the identification of component parts and the safe working loads. Copies of original certificates of manufacturers and/or testing laboratories, companies, or organizations maintained on the vessel may be accepted by the cognizant Officer in Charge, Marine Inspection, when satisfied such certificates properly describe the qualities of the component parts of the gear in question.

**§ 71.47–85 Responsibility for conducting required tests and examinations.**

(a) The vessel's owners and/or operators shall furnish and pay the expenses required in conducting the tests and examinations prescribed by the regula-

tions in this subpart, including the supplying of all instruments, other equipment, and personnel including personnel supervision for performance of all work required.

(b) The Coast Guard's participation in these required tests and examinations shall be confined to witnessing required tests and examinations with the view to determining whether or not the gear is satisfactory for the purpose intended. In the event it is determined that the gear is defective or unable to meet the standards set forth in this subpart, such gear, or portions thereof, shall be replaced to the satisfaction of the Officer in Charge, Marine Inspection, having jurisdiction over the vessel.

## Subpart 71.50—Drydocking

### § 71.50–1 When required.

(a) Except for extensions as authorized by the Commandant, all vessels making international voyages shall be placed in drydock or hauled out for examination at least once every 12 months.

(b) Except for extensions as authorized by the Commandant, all vessels not making international voyages shall be placed in drydock or hauled out for examination within the periods set forth in this paragraph, depending upon the service.

(1) Each vessel shall be drydocked or hauled out at intervals not to exceed 18 months if it operates in salt water an aggregate of more than 9 months in the 18-month period since it was last drydocked or hauled out.

(2) Each vessel shall be drydocked or hauled out at intervals not to exceed 36 months if it operates in salt water an aggregate of 6 months or less in each 12-month period since it was last drydocked or hauled out. When a vessel exceeds this aggregate amount of service in salt water in any 12-month period since it was last drydocked or hauled out, it shall be drydocked or hauled out within 6 months after the end of that period or within the 36-month interval, whichever is earlier.

(3) Each vessel shall be drydocked or hauled out at intervals not to exceed 60 months if it operates exclusively in fresh water.

### § 71.50–5 Notice by owner.

(a) The master, owner, or agent shall notify the Officer in Charge, Marine Inspection, when any vessel is to be placed on a drydock in order that an examination of the underwater portion of the vessel may be made if deemed necessary.

## Subpart 71.55—Repairs and Alterations

### § 71.55–1 Permission required.

(a) No repairs or alterations affecting the safety of the vessel with regard to the hull, machinery, or equipment, shall be made without the knowledge of the Officer in Charge, Marine Inspection.

(b) Drawings of alterations shall be approved before work is started, unless deemed unnecessary by the Officer in Charge, Marine Inspection.

(c) Drawings will not be required for repairs in kind.

### § 71.55–5 Inspection required.

(a) An inspection, either general or partial depending upon the circumstances, shall be made whenever any important repairs or alterations are undertaken.

## Subpart 71.60—Special Operating Requirements

### § 71.60–1 Inspection and testing required when making alterations, repairs, or other such operations involving riveting, welding, burning or like fire-producing actions.

(a) The provisions of "Standard for the Control of Gas Hazards on Vessels to be Repaired," NFPA No. 306, published by National Fire Protection Association, 60 Batterymarch Street, Boston, Mass., 02110, shall be used as a guide in conducting the inspections and issuance of certificates required by this section.

(b) Until an inspection has been made to determine that such operation can be undertaken with safety, no alterations, repairs, or other such operations involving riveting, welding, burning, or like fire-producing actions shall be made:

(1) Within or on the boundaries of cargo tanks which have been used to carry combustible liquid or chemicals in bulk; or,

(2) Within or on the boundaries of fuel tanks; or,

(3) To pipe lines, heating coils, pumps, fittings, or other appurtenances connected to such cargo or fuel tanks.

(c) Such inspections shall be made and evidenced as follows:

(1) In ports or places in the United States or its territories and possessions the inspection shall be made by a marine chemist certificated by the National Fire Protection Association; however, if the services of such certified marine chemist are not reasonably available, the Officer in Charge, Marine Inspection, upon the recommendation of the vessel owner and his contractor or their representative, shall select a person who, in the case of an individual vessel, shall be authorized to make such inspection. If the inspection indicated that such operations can be undertaken with safety, a certificate setting forth the fact in writing and qualified as may be required, shall be issued by the certified marine chemist or the authorized person before the work is started. Such qualifications shall include any requirements as may be deemed necessary to maintain, insofar as can reasonably be done, the safe conditions in the spaces certified throughout the operation and shall include such additional tests and certifications as considered required. Such qualifications and requirements shall include precautions necessary to eliminate or minimize hazards that may be present from protective coatings or residues from cargoes.

(2) When not in such a port or place, and a marine chemist or such person authorized by the Officer in Charge, Marine Inspection, is not reasonably available, the inspection shall be made by the senior officer present and a proper entry shall be made in the vessel's logbook.

(d) It shall be the responsibility of the senior officer present to secure copies of certificates issued by the certified marine chemist or such person authorized by the Officer in Charge, Marine Inspection. It shall be the responsibility of the senior officer present, insofar as the persons under his control are concerned, to maintain a safe condition on the vessel by full observance of all qualifications and requirements listed by the marine chemist in the certificate.

## Subpart 71.65—Plan Approval

### § 71.65–1 General.

(a) The list of required plans is general in character, but includes all plans in § 71.65–5 which normally show construction and safety features coming under the cognizance of the Coast Guard. In the case of a particular vessel, all of the plans enumerated may not be applicable, and it is intended that only those plans and specifications be submitted as will clearly show the vessel's arrangement, construction and required equipment.

(b) In the list of required plans in § 71.65–5 the items which must be approved by the American Bureau of Shipping for vessels classed by that organization are indicated by an asterisk. When prints bearing record of such approval by the American Bureau of Shipping are forwarded to the Coast Guard they will in general be accepted as satisfactory except insofar as the law or the Coast Guard regulations contain requirements which are not covered by the American Bureau of Shipping.

### § 71.65–5 Plans and specifications required for new construction.

(a) *General.* (1) Specifications.

(2) General Arrangement Plan of decks, holds, inner bottoms, etc., and including inboard and outboard profile.

(b) *Hull structure.*[1] (1) *Inner Bottom Plating and Framing.

(2) *Midship Section.

(3) *Shell Plating and Framing.

(4) *Stem, Stern Frame, and Rudder.

(5) *Structural Deck Plans for Strength Decks.

(6) *Pillars and Girders.

(7) *Watertight and Oiltight Bulkheads.

(8) *Foundations for Main Machinery and Boilers.

(9) *Arrangement of Ports, Doors, and Airports in Shell Plating.

(10) *Hatch Coamings and Covers in Weather and Watertight Decks.

(11) *Details of Subdivision Watertight Doors and Operating Gear.

(12) *Scuppers and Drains Penetrating Shell Plating.

(13) *Arrangement of the cargo gear including a stress diagram. The principal details of the gear and the safe working load for each component part shall be shown.

[1] The asterisk (*) indicates items which may require approval by the American Bureau of Shipping for vessels classed by that society.

(c) *Hull calculations, etc.* (1) Lines (for information).

(2) Curves of Form.

(3) Floodable length Curves. Including calculations and construction drawings. (These drawings shall show all watertight subdivision, including inner bottom, bulkheads, flats, shaft tunnels, pipe tunnels, escape tunnels, etc., and the location and type of all subdivision watertight doors.)

(4) Calculations of Stability in Intact and Final Flooding Conditions.

(5) Capacity Plan showing capacities and vertical and longitudinal centers of gravity of cargo spaces, tanks, etc. (for information).

(6) Tank Sounding Tables (for information).

(7) Draft Mark Locations (for information).

(d) *Fire control.* (1) Fire control diagram showing location and type of all required fire-screen insulation, including main fire zone and subdivisions, stairway and elevator enclosures, control space enclosures, etc., and type of all doors in such subdivisions and enclosures.

(2) Comprehensive typical details of fire-screen insulation of both vertical and horizontal surfaces, including deck coverings where used, keyed by reference numbers to the "fire control diagram".

(3) Ventilation diagram including dampers and other fire control features.

(4) Alarm systems.

(5) Detecting systems.

(6) Extinguishing systems, including fire mains, carbon dioxide, foam, and sprinkling systems.

(7) Supervised Patrol Route.

(e) *Marine engineering.* (1) For plans required for marine engineering equipment and systems, see Subchapter F (Marine Engineering) of this chapter.

(f) *Electrical engineering.* (1) For plans required for electrical engineering equipment and systems, see Subchapter J (Electrical Engineering) of this chapter.

(g) *Lifesaving equipment.* (1) These plans are to show the location and arrangement of embarkation decks, all overboard discharges and projections in way of launching lifeboats, weights of lifeboats fully equipped and loaded, working loads of davits and winches, types and sizes of falls, the manufacturer's name and identification for all equipment, and all other relevant and necessary information.

(i) Arrangement of lifeboats.

(ii) Arrangement of davits.

(iii) Location and stowage of liferafts and buoyant apparatus.

(h) *Crew's accommodations.* (1) Arrangement plans showing accommodations, ventilation, escapes, hospital, and sanitary facilities for all crewmembers.

**§ 71.65–10 Plans required for alterations of existing vessels.**

(a) In the event of alterations involving the safety of the vessel, the applicable plans shall be submitted for approval covering the proposed work, except as modified by § 71.55–1(b). The general scope of the plans shall be as noted in § 71.65–5.

**§ 71.65–15 Procedure for submittal of plans.**

(a) As the relative location of shipyards, design offices, and Coast Guard offices vary throughout the country, no specific routing will be required in the submittal of plans. In general, one of the following procedures would apply, but in a particular case, if a more expeditious procedure can be used, there will be no objection to its adoption:

(1) The plans may be submitted to the Officer in Charge, Marine Inspection, in the district in which the vessel is to be built. This procedure will be most expeditious in the case of those offices where personnel and facilities are available for examination and approval of the plans locally.

(2) The plans may be submitted directly to the Commandant (MMT), U. S. Coast Guard, 1300 "E" Street, NW., Washington, D.C., 20226. In this case, the plans will be returned directly to the submitter, with a copy of the action being forwarded to the interested Officer in Charge, Marine Inspection.

(3) The plans may be submitted directly to field technical offices:

(i) Commander, 3d Coast Guard District (mmt), 45 Broadway, New York, N.Y., 10006, for geographical area covered by 1st, 3d, and 5th Coast Guard Districts.

(ii) Commander, 8th Coast Guard District (mmt), Room 308, Custom House, New Orleans, La., 70130, for geographical area covered by 2d, 7th, and 8th Coast Guard Districts.

(iii) Commander, 12th Coast Guard District (mmt), 630 Sansome St., San Francisco, Calif., 94501, for geographical area covered by 11th, 12th, 13th, 14th, and 17th Coast Guard Districts.

(4) In the case of classed vessels, upon specific request by the submitter, the American Bureau of Shipping will arrange to forward the necessary plans to the Coast Guard indicating its action thereon. In this case, the plans will be returned as noted in subparagraph (2) of this paragraph.

**§ 71.65–20 Number of plans required.**

(a) Four copies of each plan are normally required so that one can be returned to the submitter. If the submitter desires additional approved plans, a suitable number should be submitted to permit the desired distribution.

## Subpart 71.75—Certificates Under the International Convention for Safety of Life at Sea, 1960

**§ 71.75–1 Application.**

(a) The provisions of this subpart shall apply to all vessels on an international voyage.

**§ 71.75–5 Passenger Ship Safety Certificate or Nuclear Passenger Ship Safety Certificate.**

(a) All vessels on an international voyage are required to have a "Passenger Ship Safety Certificate" or a "Nuclear Passenger Ship Safety Certificate," as appropriate.

(b) All such vessels shall meet the requirements of this chapter for vessels on an international voyage.

**§ 71.75–10 Exemption Certificate.**

(a) A vessel may be exempted by the Commandant from complying with certain requirements of the Convention under his administration upon request made in writing to him and transmitted via the Officer in Charge, Marine Inspection.

(b) When an exemption is granted to a vessel by the Commandant under and in accordance with the Convention, an Exemption Certificate describing such exemption shall be issued through the appropriate Officer in Charge, Marine Inspection, in addition to the Passenger Ship Safety Certificate.

(c) Nuclear vessels cannot be exempted from any requirements of the International Convention for Safety of Life at Sea, 1960.

**§ 71.75–15 Posting of Convention certificates.**

(a) The certificates described in this subpart, or certified copies thereof, when issued to a vessel shall be posted in a prominent and accessible place on the vessel.

(b) The certificate shall be carried in a manner similar to that described in § 71.01–5 for a certificate of inspection.

**§ 71.75–20 Duration of certificates.**

(a) The certificates shall be issued for a period of not more than 12 months.

(b) An Exemption Certificate shall not be valid for longer than the period of the Passenger Ship Safety Certificate to which it refers.

(c) The Passenger Ship Safety Certificate or the Nuclear Passenger Ship Safety Certificate may be withdrawn, revoked, or suspended at any time when it is determined the vessel is no longer in compliance with applicable requirements. (See § 2.01–70 of this chapter for procedures governing appeals.)

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# PART 72—CONSTRUCTION AND ARRANGEMENT

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72.20-90 Vessels contracted for prior to November 19, 1952.

Subpart 72.25—Passenger Accommodations

72.25-1 Application.
72.25-5 Steerage passengers.
72.25-10 Location of passenger quarters.
72.25-15 Passenger accommodations for excursion boats, ferryboats, and passenger barges.

Subpart 72.40—Rails and Guards

72.40-1 Application.
72.40-5 Where rails required.
72.40-10 Storm rails.
72.40-15 Vehicular ferries.
72.40-20 Guards in dangerous places.
72.40-90 Vessels contracted for prior to November 19, 1952.

AUTHORITY: The provisions of this Part 72 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4399, as amended, 4400, as amended, 4417, as amended, 4418, as amended, 4421, as amended, 4426, as amended, 4433, as amended, 4453, as amended, 4488, as amended, 4490, as amended, 4491, as amended, sec. 14, 29 Stat. 690, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, sec. 5, 49 Stat. 1384, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 361, 362, 391, 392, 399, 404, 411, 435, 481, 482, 489, 366, 395, 363, 369, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167-14, Nov. 26, 1954, 19 F.R. 8026; 167-20, June 18, 1956, 21 F.R. 4894; CGFR 56-28, July 24, 1956, 21 F.R. 5659; 167-38, Oct. 26, 1959, 24 F.R. 8857, unless otherwise noted.

## Subpart 72.01—Hull Structure

### §72.01-1 Application.

(a) The provisions of this subpart, with the exception of § 72.01-90, shall apply to all vessels contracted for on or after November 19, 1952, which are not subject to the act of May 10, 1956 (46 U.S.C. 390-390g). Vessels contracted for prior to November 19, 1952, which are not subject to the act of May 10, 1956, shall meet the requirements of § 72.01-90. The application of this subpart to vessels subject to the act of May 10, 1956, shall be in accordance with the policy expressed in § 70.05-15 of this subchapter.

### § 72.01-5 Vessels subject to load line.

(a) For vessels assigned a load line, see Subchapter E (Load Lines) of this chapter, for special requirements as to strength, closure of openings, etc.

(Sec. 2, 45 Stat. 1493, as amended, sec. 2, 49 Stat. 888, as amended; 46 U.S.C. 85a, 88a. Treasury Department Order 167-48, Oct. 19, 1962, 27 F.R. 10504)

### § 72.01-10 Vessels using fuel having a flashpoint of 110 degrees F. or lower.

(a) Where liquid fuel having a flashpoint of 110 degrees F. or lower is carried for main or auxiliary machinery or for starting purposes, such machinery and fuel tanks shall be in separate vapor tight compartments separating each from the other and from the remainder of the vessel.

### § 72.01-15 Structural standards.

(a) In general, compliance with the standards established by the American Bureau of Shipping, see Subpart 70.35 of this subchapter, will be considered satisfactory evidence of the structural efficiency of the vessel. However, in special cases, a detailed analysis of the entire structure or some integral part may be made by the Coast Guard to determine the structural requirements.

### § 72.01-20 Special consideration.

(a) Special consideration will be given to the structural requirements for vessels, such as small vessels or vessels of unusual design not contemplated by the standards established by the American Bureau of Shipping, see Subpart 70.35 of this subchapter.

### § 72.01-25 Structural subdivision requirements.

(a) Vessels required by Part 73 of this subchapter to have subdivision bulkheads, double bottoms, etc., shall comply with the following structural subdivision requirements:

(1) Each watertight subdivision bulkhead, whether transverse or longitudinal, shall be constructed in such a manner that it shall be capable of supporting, with a proper margin of resistance, the pressure due to the maximum head of water which it might have to sustain in the event of damage to the vessel, but at least the pressure due to a head of water up to the margin line. The construction of the bulkheads shall be to the satisfaction of the Commandant.

(2) Steps and recesses in subdivision bulkheads shall be watertight and as strong as the bulkhead at the place where each occurs. Decks, trunks, tunnels, duct keels, ventilators, etc., that are made watertight to maintain the subdivision requirements for a vessel shall be of the same strength as the bulkhead at the corresponding levels. The means used for making them watertight and the arrangements adopted for closing openings in them shall be to the satisfaction of the Commandant. Watertight ventilators and trunks shall be carried at least up to the bulkhead deck.

(3) Where frames or beams pass through a watertight bulkhead or deck, such bulkhead or deck shall be made structurally watertight without the use of wood, cement, or similar materials.

(4) Subdivision bulkheads, including steps, recesses, trunks, tunnels, ventilators, etc., which might form part of such bulkheads, shall be thoroughly examined and hose tested upon completion of construction. The water pressure for such tests shall be at least 30 p. s. i. Testing of main compartments by filling them with water is not compulsory.

(5) The forepeak, double bottoms (including duct keels), and inner skins shall be tested with water to-a-head corresponding to the requirements of subparagraph (1) of this paragraph upon completion of construction.

(6) The watertight space enclosing the stern tube shall be tested by filling with water to-a-head up to the deepest subdivision load line.

(7) Tanks which are intended to hold liquids, and which form part of the subdivision of the vessel, shall be tested for tightness upon completion of construction with water to-a-head up to the deepest subdivision load line or to-a-head corresponding to ⅔ of the depth from the top of the keel to the margin line in way of the tanks, whichever is greater; but in no case shall the test-head be less than 3 feet above the top of the tank.

(8) The tests referred to in the preceding subparagraphs (5), (6), and (7) of this paragraph, are for the purpose of insuring that the subdivision structural arrangements are watertight and are not regarded as a test of the fitness of any compartment for the storage of oil, fuel or for other specific purposes for which a test of a superior character may be required depending upon the height to which the liquid has access in the tank or its connections.

### § 72.01-90 Vessels contracted for prior for November 19, 1952.

(a) Existing structure previously approved will be considered satisfactory so long as it is maintained in good condition to the satisfaction of the Officer in

Charge, Marine Inspection. Minor repairs and alterations may be made to the same standard as the original construction.

## Subpart 72.03—General Fire Protection

### § 72.03–1 Application.

(a) The provisions of this subpart shall apply to all vessels.

### § 72.03–5 Fire hazards to be minimized.

(a) The general construction of the vessel shall be such as to minimize fire hazards insofar as is reasonable and practicable.

### § 72.03–10 Woodwork insulated from heated surfaces.

(a) Internal combustion engine exhausts, boiler and galley uptakes and similar sources of ignition shall be kept clear of and suitably insulated from any woodwork or other combustible matter.

### § 72.03–15 Lamp room construction.

(a) Lamp, paint, and oil lockers and similar compartments shall be constructed of steel or shall be wholly lined with metal.

## Subpart 72.05—Structural Fire Protection

### § 72.05–1 Application.

(a) The provisions of this subpart shall apply to the following vessels:

(1) All vessels of 100 gross tons and over.

(2) All vessels which carry more than 150 passengers.

(3) All vessels on an international voyage.

(b) The provisions of this subpart, with the exception of § 72.05–90, shall apply to all vessels noted in paragraph (a) of this section contracted for on or after May 26, 1965. Such vessels contracted for prior to May 26, 1965, shall meet the requirements of § 72.05–90.

### § 72.05–5 Definitions.

NOTE: The parenthetical number after each space refers to the applicable column and row number in Tables 72.05–10 (d) through (g).

(a) "Safety areas" will be considered as including the following spaces:

(1) Control stations, i.e., spaces containing the emergency source of power, and those spaces in which a continuous watch is maintained and in which navigating, radio, or fire-control equipment is located. (1)

(2) Passenger and crew stairway and elevator enclosures. (2)

(3) Passenger and crew communicating corridors. (3)

(4) Open decks and enclosed promenades in way of lifeboat embarkation or lowering positions. (4) (See also paragraph (l) of this section.)

(b) "Accommodation spaces" will be considered as including the following spaces:

(1) Public spaces, such as halls, dining rooms, messrooms, lounges, cafes, and other similar spaces normally accessible during the voyage. (5) through (7) (Depending upon size and furnishings.)

(2) Public sales rooms and similar spaces. (6) or (7) (Depending on size.)

(3) Staterooms, including passenger and crew rooms, barber shops, beauty parlors, offices, dispensaries, etc. (5) or (6) (Depending on furnishings.)

(4) Washrooms and toilet spaces, both public and private. (8)

(5) Isolated lockers and small storerooms in accommodation areas. (6)

(6) Isolated serving pantries, etc., in accommodation areas, with incombustible furnishings. (8)

(7) Operating rooms. (8)

(8) Small laundries containing only tubs and washing machines, with no facilities for drying other than small electric driers. (8)

(9) Small cleaning gear lockers containing only slop sinks, and having no room for stowing materials other than a broom, mop, cleaning powder, soap, etc. (8)

(10) Large cleaning gear lockers having considerable stowage space. (6) or (9)

(c) "Service spaces" will be considered as including the following spaces:

(1) Motion picture projection rooms and film stowage rooms. (6) or (9)

(2) Galleys, main pantries, and storerooms, including alleyways and stairs, part of and for the exclusive use of such spaces. (9)

(3) Diet kitchens. (6) or (9) (Depending on furnishing.)

(4) Work shops (not part of machinery spaces, galleys, etc.), large laundries, drying rooms, mail and baggage rooms, etc. (9)

(5) Garbage disposal and stowage rooms, and trash stowage rooms. (9)

(6) Paint and lamp rooms, and similar spaces containing highly combustible materials. (9)

(d) "Machinery spaces" will be considered as including the following spaces:

(1) Main machinery spaces, including trunks and casings, alleyways, gratings, and stairways, part of and for the exclusive use of these spaces, auxiliary machinery spaces containing internal combustion machinery or other oil burning, heating, or pumping units, and fuel oil filling stations. (10)

(2) Auxiliary machinery spaces containing only pumps, tanks, electrical machinery, ventilation or air conditioning equipment, resistors, steering machinery, stabilizer machinery, etc. (12) (Where such spaces contain considerable stowage space for combustibles.) (10)

(e) "Cargo spaces" will be considered as including the following spaces:

(1) Cargo holds, lockers, and trunks, both accessible and inaccessible and including refrigerated cargo spaces and cargo oil tanks intended for the alternate carriage of dry cargo. (11)

(2) Cargo oil tanks if not intended for the alternate carriage of dry cargo. (12)

(f) "Miscellaneous spaces" will be considered as including the following spaces:

(1) Fuel and water tanks and voids. (12)

(2) Open decks and enclosed promenades except in way of lifeboat embarkation and lowering positions. (13) (See also paragraph (l) of this section.)

(3) Shaft alleys when separated from machinery spaces, and containing no space assigned for the stowage of combustibles. (12)

(g) A "standard fire test" is one which develops in the test furnace a series of time-temperature relationships as follows:

| | |
|---|---|
| 5 minutes | 1,000° F. |
| 10 minutes | 1,300° F. |
| 30 minutes | 1,550° F. |
| 60 minutes | 1,700° F. |

(h) "Main vertical zones" are those sections, the mean length of which does not, in general, exceed 131 feet on any one deck, into which the hull, superstructure, and deckhouses are required to be divided by fire-resisting bulkheads.

(i) Where the term "steel or other equivalent metal" is used in this part, it is intended to require a material which, by itself or due to insulation provided, has structural and integrity qualities equivalent to steel at the end of the applicable fire exposure.

(j) Working spaces will be considered as only those service and machinery spaces where personnel are normally employed as contrasted to those where personnel may occasionally visit or be employed for short periods of time.

(k) Passenger or crew corridors over 8 feet in width will be considered as public spaces for the purpose of this subpart.

(l) Spaces which might be considered as open decks due to the presence of permanent openings to the weather in one or more sides, or where any or all sides may be completely open to the weather, will be considered as interior or enclosed spaces for the purpose of this subpart if any spot on the overhead is more than 15 feet from the nearest opening to the weather. This requirement shall only apply to those portions of the space as are under a deck or canopy, but it shall not be considered as a restriction against permanent opening or a restriction against the materials used for a canopy. This paragraph shall not apply to open or enclosed promenades having a nominal width of 15 feet or less.

(m) Where balconies are installed opening into a space, the following general requirements shall be met:

(1) For the purpose of meeting main vertical zone bulkhead spacing, the length of the space to which the balcony is open will be considered as being increased by an amount equal to the gross area of the balcony divided by the average width of the space.

(2) Where balconies are formed by penetrating one or more decks, the bulkheads in the upper portion of the space are, in effect, part of a stepped or recessed deck and should be treated as such for fire control purposes. In this regard, particular attention should be given to the protection of openings with proper doors of the type indicated in § 72.05–25(b) (9).

(3) Two means of escape shall be provided for each balcony, at least one of which shall be independent of the space to which the balcony is open.

**§ 72.05–10 Type, location, and construction of fire control bulkheads and decks.**

(a) The hull, structural bulkheads, decks, and deckhouses shall be constructed of steel or other equivalent metal construction of appropriate scantlings.

(b) The hull, superstructure, and deck houses shall be subdivided by suitable structural steel or other equivalent metal bulkheads into main vertical zones, the mean length of which shall not, in general, exceed 131 feet on any one deck. Where practicable, the main vertical zone bulkheads shall be kept in a single vertical plane. However, on vessels designed for special purposes, such as automobile or railroad car ferries, where the installation of such bulkheads would defeat the purpose for which the vessel is intended, equivalent means for controlling and limiting a fire may be substituted if specifically approved by the Commandant.

(c) All bulkheads and decks shall be classed as A–60, A–30, A–15, A–0, B–15, B–0, or C, depending upon the type of space on each side of the bulkhead or above and below the deck.

(1) Bulkheads or decks of the "A" Class shall be composed of steel or equivalent metal construction, suitably stiffened and made intact with the main structure of the vessel, such as shell, structural bulkheads, and decks. They shall be so constructed that, if subjected to the standard fire test, they would be capable of preventing the passage of smoke and flame for 1 hour. In addition, they shall be so insulated with approved structural insulation, bulkhead panels, or deck covering that the average temperatures on the unexposed side would not rise more than 250° F. above the original temperature, nor would the temperature at any one point, including any joint, rise more than 325° F. above the original temperature, within the time listed below:

Class A–60..... 60 minutes.
Class A–30..... 30 minutes.
Class A–15..... 15 minutes.
Class A–0..... 0 minutes (i.e., no insulation requirements).

(2) Bulkheads of the "B" Class shall be constructed with approved incombustible materials and made intact from deck to deck (or to ceiling as provided in paragraph (h) of this section) and to shell or other boundaries. They shall be so constructed that, if subjected to the standard fire test, they would be capable of preventing the passage of flame for ½ hour. In addition, their insulation value shall be such that the average temperature of the unexposed side would not rise more than 250° F. above the original temperature, nor would the temperature at any one point, including any joint, rise more than 405° F. above the original temperature within the time listed below:

Class B–15..... 15 minutes.
Class B–0..... 0 minutes (i.e., no insulation requirements).

(3) Class C bulkheads or decks shall be constructed of approved incombustible materials, but need meet no requirements relative to the passage of flame nor the limiting of temperature rise.

(d) The minimum requirements for the bulkheads between the various spaces, where such bulkheads form the boundaries of main vertical zones, shall be as noted in Table 72.05–10(d).

(e) The minimum requirements for the bulkheads between the various spaces, where such bulkheads do not form the boundaries of main vertical zones, shall be as noted in Table 72.05–10 (e).

(f) The minimum requirements for the decks between the various spaces, where such decks form the boundaries of stepped main vertical zones, shall be as noted in Table 72.05–10(f).

(g) The minimum requirements for the decks between the various spaces, where such decks do not form the boundaries of stepped main vertical zones, shall be as noted in Table 72.05–10(g).

(h) Where ceilings or linings are fitted, "B" Class bulkheads, with the exception of those forming passageways, may stop at the ceiling or lining and need not continue to the deck or shell, provided the ceiling and/or lining is erected as indicated in paragraph (j) of this section. However, draft stops meeting at least Class B–O requirements shall be fitted not more than 45 feet apart between the ceiling or lining and the deck or shell. The space behind the linings of stairways and similar trunks shall have similar draft stops at each deck.

(i) Where Class B–15 bulkhead panels are required to go beyond the ceiling to the deck above, or beyond the lining to the shell, the portion of the bulkhead panel within the void space need only meet B–O requirements.

(j) Where "B" Class panels are used, all four edges of the panel shall be retained by continuous steel or equivalent metal flanges on both sides of the panel offering at least ¾ inch coverage. The top and bottom flanges shall be so attached to the structural decks above and below so as to support and restrain the panels in the event of fire. Other methods of construction may be specifically approved by the Commandant if determined to be equivalent.

(k) Any sheathing, furring, or holding pieces incidental to the securing of structural insulation shall be of approved incombustible materials.

TABLE 72.05–10(d)—BULKHEADS—MAIN VERTICAL ZONE

| This space → / Adjacent to this space ↓ | | Control stations | Stairway and elevator enclosures | Corridors | Lifeboat embarkation or lowering stations | Staterooms and all public spaces with incombustible veneers and trim and fire resistant furnishings | Staterooms and public spaces of 500 square feet or less with combustible furnishings and isolated storerooms | Public spaces over 500 square feet with combustible furnishings | Washrooms, toilet spaces, and isolated pantries with incombustible fittings | Galleys, main pantries, storerooms, and workshops | Machinery spaces | Dry cargo spaces | Fuel and water tanks and voids | Open decks and enclosed promenades (not safety areas) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Control stations | 1 | A–60 | A–15 | A–15 | A–0 | A–30 | A–60 | A–60 | A–0 | A–60 | A–60 | A–60 | A–0 | A–0 |
| Stairway and elevator enclosures | 2 | ..... | A–0 | A–0 | A–0 | A–0 | A–60 | A–60 | A–0 | A–60 | A–60 | A–60 | A–0 | A–0 |
| Corridors | 3 | ..... | ..... | A–0 | A–0 | A–0 | A–0 | A–0 | A–0 | A–0 | A–0 | A–0 | A–0 | A–0 |
| Lifeboat embarkation or lowering stations | 4 | ..... | ..... | ..... | C | A–0 | A–0 | A–0 | A–0 | A–0 | A–0 | A–0 | A–0 | C |
| Staterooms and all public spaces with incombustible veneers and trim and fire resistant furnishings | 5 | ..... | ..... | ..... | ..... | A–15 | A–15 | A–15 | A–0 | A–30 | A–30 | A–60 | A–0 | A–0 |
| Staterooms and public spaces of 500 square feet or less with combustible furnishings, and isolated storerooms | 6 | ..... | ..... | ..... | ..... | ..... | A–60 | A–60 | A–0 | A–60 | A–60 | A–60 | A–0 | A–0 |
| Public spaces over 500 square feet with combustible furnishings | 7 | ..... | ..... | ..... | ..... | ..... | ..... | A–30 | A–0 | A–60 | A–60 | A–60 | A–0 | A–0 |
| Washrooms, toilet spaces, and isolated pantries with incombustible fittings | 8 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | A–0 | A–0 | A–0 | A–0 | A–0 | A–0 |
| Galleys, main pantries, storerooms, and workshops | 9 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | A–0 | A–0 | A–0 | A–0 | A–0 |
| Machinery spaces | 10 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | A–0 | A–0 | A–0 | A–0 |
| Dry cargo spaces | 11 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | A–0 | A–0 | A–0 |
| Fuel and water tanks and voids | 12 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | A–0 | A–0 |
| Open decks and enclosed promenades (not safety areas) | 13 | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | ..... | C |

TABLE 72.05-10(e)—BULKHEADS—NOT MAIN VERTICAL ZONES

| This space → / Adjacent to this space ↓ | | Control stations | Stairway and elevator enclosures | Corridors | Lifeboat embarkation or lowering stations | Staterooms and all public spaces with incombustible veneers and trim and fire-resistant furnishings | Staterooms and public spaces of 500 square feet or less with combustible furnishings and isolated storerooms | Public spaces over 500 square feet with combustible furnishings | Washrooms, toilet spaces, and isolated pantries with incombustible fittings | Galleys, main pantries, storerooms, and workshops | Machinery spaces | Dry cargo spaces | Fuel and water tanks and voids | Open decks and enclosed promenades (not safety areas) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Control stations | 1 | B-0 | A-0 | A-0 | A-0 | A-15 | A-60 | A-60 | A-0 | A-60 | A-60 | A-60 | A-0 | A-0 |
| Stairway and elevator enclosures | 2 | ---- | C | A-0 | A-0 | A-0 | A-60 | A-60 | A-0 | A-60 | A-60 | A-60 | A-0 | A-0 |
| Corridors | 3 | ---- | ---- | C | A-0 | B-0 | B-0 | A-0 | B-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Lifeboat embarkation or lowering stations | 4 | ---- | ---- | ---- | C | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | C |
| Staterooms and all public spaces with incombustible veneers and trim and fire-resistant furnishings | 5 | ---- | ---- | ---- | ---- | B-0 | B-15 | A-15 | B-0 | A-15 | A-15 | A-15 | A-0 | A-0 |
| Staterooms and public spaces of 500 square feet or less with combustible furnishings, and isolated storerooms | 6 | ---- | ---- | ---- | ---- | ---- | B-15 | A-30 | B-0 | A-60 | A-60 | A-60 | A-0 | A-0 |
| Public spaces over 500 square feet with combustible furnishings | 7 | ---- | ---- | ---- | ---- | ---- | ---- | A-60 | B-0 | A-60 | A-60 | A-60 | A-0 | A-0 |
| Washrooms, toilet spaces and isolated pantries with incombustible fittings | 8 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | C | A-0 | A-0 | A-0 | A-0 | A-0 |
| Galleys, main pantries, storerooms, and workshops | 9 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | C [1] | A-0 | A-0 | A-0 | A-0 |
| Machinery spaces | 10 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | C | A-0 | A-0 | A-0 |
| Dry cargo spaces | 11 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | A-0 | A-0 | A-0 |
| Fuel and water tanks and voids | 12 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | A-0 | A-0 |
| Open decks and enclosed promenades (not safety areas) | 13 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- | C |

[1] Class C bulkheads may be used between two similar spaces, such as between two similar storerooms. However, a Class A-0 bulkhead shall be used between dissimilar spaces, such as a storeroom and a dissimilar workshop.

TABLE 72.05-10(f)—DECKS—MAIN VERTICAL ZONES

| This space above → / This space below ↓ | | Control stations | Stairway and elevator enclosures | Corridors | Lifeboat embarkation or lowering stations | Staterooms and all public spaces with incombustible veneers and trim and fire resistant furnishings | Staterooms and public spaces of 500 square feet or less with combustible furnishings and isolated storerooms | Public spaces over 500 square feet with combustible furnishings | Washrooms, toilet spaces, and isolated pantries with incombustible fittings | Galleys, main pantries, storerooms, and workshops | Machinery spaces | Dry cargo spaces | Fuel and water tanks and voids | Open decks and enclosed promenades (not safety areas) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Control stations | 1 | A-60 | A-60 | A-30 | A-0 | A-15 | A-60 | A-60 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Stairway and elevator enclosures | 2 | A-15 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Corridors | 3 | A-30 | A-0 | A-0 | A-0 | A-0 | A-0 | A-15 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Lifeboat embarkation or lowering stations | 4 | A-0 | A-0 | A-0 | C | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | C |
| Staterooms and all public spaces with incombustible veneers and trim and fire resistant furnishings | 5 | A-30 | A-30 | A-15 | A-0 | A-15 | A-15 | A-30 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Staterooms and public spaces of 500 square feet or less with combustible furnishings, and isolated storerooms | 6 | A-60 | A-60 | A-30 | A-15 | A-15 | A-60 | A-60 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Public spaces over 500 square feet with combustible furnishings | 7 | A-60 | A-60 | A-60 | A-30 | A-30 | A-60 | A-60 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Washrooms, toilet spaces, and isolated pantries with incombustible fittings | 8 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Galleys, main pantries, storerooms, and workshops | 9 | A-60 | A-60 | A-60 | A-30 | A-30 | A-60 | A-60 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Machinery spaces | 10 | A-60 | A-60 | A-60 | A-30 | A-30 | A-60 | A-60 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Dry cargo spaces | 11 | A-60 | A-60 | A-60 | A-30 | A-30 | A-60 | A-60 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Fuel and water tanks and voids | 12 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Open decks and enclosed promenades (not safety areas) | 13 | A-0 | A-0 | A-0 | C | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | C |

TABLE 72.05-10(g)—DECKS—NOT MAIN VERTICAL ZONES

| This space above → / This space below ↓ | | Control stations | Stairway and elevator enclosures | Corridors | Lifeboat embarkation or lowering stations | Staterooms and all public spaces with incombustible veneers and trim and fire resistant furnishings | Staterooms and public spaces of 500 square feet or less with combustible furnishings and isolated storerooms | Public spaces over 500 square feet with combustible furnishings | Washrooms, toilet spaces, and isolated pantries with incombustible fittings | Galleys, main pantries, storerooms, and workshops | Machinery spaces | Dry cargo spaces | Fuel and water tanks and voids | Open decks and enclosed promenades (not safety areas) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Control stations | 1 | A-30 | A-30 | A-15 | A-0 | A-0 | A-15 | A-30 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Stairway and elevator enclosures | 2 | A-0 | C | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Corridors | 3 | A-15 | A-0 | A-0 | A-0 | A-0 | A-0 | A-15 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Lifeboat embarkation or lowering stations | 4 | A-0 | A-0 | A-0 | C | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | C |
| Staterooms and all public spaces with incombustible veneers and trim and fire resistant furnishings | 5 | A-15 | A-15 | A-0 | A-0 | A-0 | A-0 | A-15 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Staterooms and public spaces of 500 square feet or less with combustible furnishings and isolated storerooms | 6 | A-60 | A-60 | A-30 | A-15 | A-0 | A-30 | A-60 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Public spaces over 500 square feet with combustible furnishings | 7 | A-60 | A-60 | A-60 | A-30 | A-15 | A-60 | A-60 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Washrooms, toilet spaces, and isolated pantries with incombustible fittings | 8 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Galleys, main pantries, storerooms, and workshops | 9 | A-60 | A-60 | A-60 | A-30 | A-15 | A-60 | A-60 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Machinery spaces | 10 | A-60 | A-60 | A-60 | A-30 | A-15 | A-60 | A-60 | A-0 | A-0 | C | A-0 | A-0 | A-0 |
| Dry cargo spaces | 11 | A-60 | A-60 | A-60 | A-30 | A-15 | A-60 | A-60 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Fuel and water tanks and voids | 12 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 |
| Open decks and enclosed promenades (not safety areas) | 13 | A-0 | A-0 | A-0 | C | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | A-0 | C |

(l) Where linings or bulkhead panels are framed away from the shell or structural bulkheads, the deck within the void space so formed need only meet Class A-O requirements.

(m) Accommodation spaces, other than washrooms and toilet spaces, separated from corridors or other spaces covered by the supervised patrol by bulkheads of the "B" Class shall have a louver in the door. In lieu of the louver in the door, a screened opening approximately one inch in diameter will be accepted. Such opening to permit smoke to be detected by the patrol, shall be located as high as practicable in the bulkhead. In the event of a double bulkhead or similar construction, a suitable hollow sleeve or tube shall connect the inner and outer surfaces of the bulkhead.

(n) Decks within accommodation spaces and inside safety areas may have an overlay for leveling or finishing purposes which need not meet the requirements for an approved deck covering. Such an overlay will not be considered as giving any insulating value and may not in general exceed ⅜ of an inch in thickness. Greater thicknesses may be specifically approved by the Commandant for specific locations.

(o) Rugs and carpets may be used in addition to any deck covering or overlay installed. Rugs and carpets used in stairways or corridors shall be of wool, or other materials having equivalent fire-resistive qualities.

(p) Decking within surgical operating rooms shall be of a type which is acceptably conductive to prevent accumulation of dangerous electrostatic charges, and shall be in general agreement with "Code for Flammable Anesthetics." of issue in effect at the time the construction or alteration of the vessel is contracted for, published by the National Fire Protection Association, 60 Batterymarch Street, Boston, Mass., 02110.

(q) Decks in washrooms and toilet spaces, service, cargo, and machinery spaces, open decks, exterior safety areas, and enclosed promenades may have an overlay in any thickness. This overlay need not meet the requirements for an approved deck covering.

### § 72.05-15 Ceilings, linings, trim, and decorations in accommodation spaces and safety areas.

(a) Ceilings and linings and any furring incidental to their erection shall be of approved incombustible materials. Where such ceilings or linings are given credit for their insulating value in obtaining a bulkhead or deck classification they shall be of Class B-15 bulkhead panel material, and the construction shall be as required by § 72.05-10(j).

(b) Bulkheads, linings, and ceilings may have a combustible veneer within a room not to exceed 2/28 of an inch in thickness. However, combustible veneers shall not be used in passageways or stairway enclosures, or in spaces specifically restricted by Tables 72.05-10 (d) through (g).

(c) The total volume of combustible face trim, moldings, and decorations, including veneers, in any compartment shall not exceed a volume equivalent to 1/10 inch veneer on the combined area of the walls of the compartment. Such trim, molding, or decorations shall not perform any structural function, and shall not be used in corridors or stairway enclosures.

(d) Combustible veneers, trim, decorations, etc., shall not be used in or extend into hidden spaces such as behind linings or ceilings or in the interior of double bulkheads.

(e) Nothing in this subpart shall be construed as prohibiting the covering of any surface with a reasonable number of coats of paint or with a Marine Finish meeting the requirements of Subpart 164.012 of Subchapter Q (Specifications) of this chapter. This includes corridors, stairway enclosures, and hidden spaces.

(f) Partial bulkheads or decks used to subdivide a space for artistic treatment, privacy, etc., shall meet the requirements of Class C bulkheads.

### § 72.05-20 Stairways, ladders, and elevators.

(a) (1) Except as further noted, the provisions of this section apply to all vessels.

(2) For small vessels, special consideration for relief may be given where it is shown to be unreasonable or impracticable to meet the detailed requirements for stairway size, slope, dimensioning, and landing area.

(3) Stairways, ladders, and elevators within main machinery spaces or cargo holds are not covered by the general provisions of this section, but shall meet the requirements of paragraph (b) of this section.

(b) Stairways, ladders, and elevators within main machinery spaces and cargo holds shall meet the following requirements:

(1) All stairways, ladders, and elevators shall be of steel.

(c) Deck penetrations shall meet the following requirements:

(1) Where a continuous vertical deck penetration for a stairway or elevator exceeds one deck, the integrity of all decks involved shall be assured by enclosure bulkheads and decks meeting the applicable requirements of § 72.05-10 (d) through (g), and by doors at all levels meeting the requirements of § 72.05-25 (b) (9).

(2) Where only two decks are served by a stairway or elevator, the integrity of the deck involved may be assured as noted in the preceding paragraph. Alternately, the integrity may be maintained at one level only by means of bulkheads and by doors meeting the requirements of § 72.05-25(b) (9). If the latter method is used, it should be noted

that the integrity of a deck is involved, and accordingly, the bulkhead classifications should be selected from Tables 72.05–10(f) or 72.05–10(g), the spaces above or below being assumed to extend to the bulkheads and doors.

(3) Stairways or elevators to a balcony within a space need not be enclosed, provided the stairway or elevator serves only the space and the balcony within the space.

(d) For the purpose of this section, stairways are identified as follows:

Type 1—Main Vertical Zone enclosed stair towers.

Type 2—Enclosed stairways other than Type 1.

Type 3—Interior stairway not enclosed.

Type 4—Exterior stairways or exterior inclined ladders.

(e) Each Main Vertical Zone shall be served by at least one Type 1 stairway, so that independent of adjoining Main Vertical Zones, escape may be effected from any accommodation space or any other space where persons may be normally quartered or employed, to ALL other decks having any such spaces within the same Main Vertical Zone without coming out of the stair tower enclosure. Each Type 1 stairway shall give access to the Embarkation Deck or, if the Embarkation Deck does not extend to the portion of the vessel in question, to at least one weather deck from which convenient communication to the Embarkation Deck is provided by means of Type 4 stairways. In cases where a Type 1 stairway is accessible from two Main Vertical Zones, it may be considered as the required Type 1 stairway for both zones provided all boundaries of the stairway meet Main Vertical Zone requirements.

(f) Insofar as is reasonable and practicable, Types 1 and 2 stairways, and all elevator enclosures, should not give direct access to accommodations or other enclosed spaces in which a fire may originate.

(g) The furnishings for Types 1 and 2 stairways, and all elevator enclosures, shall be as set forth in § 72.05–55(c).

(h) In general, curved, spiral, or winding stairways will not be permitted. Relaxation from this requirement may be permitted, provided, in the opinion of the Commandant, the proposed stairway is equivalent with respect to safety and dimensions to the stairways covered by this section.

(i) For all types of stairways, the stairs, platforms, and landings shall be of sufficient strength to sustain a load of 100 pounds per square foot with a factor of safety of 4 based on the ultimate strength.

(j) The stringers, treads, and all platforms and landings of all Types 1, 2, and 3 stairways shall be of solid steel construction. Risers shall be of approved incombustible material.

(k) For all types of stairways, handrails shall be fitted on both sides of the stairs. For stairways in excess of 66 inches in width, additional center handrails shall be provided. All handrails shall be fitted at a vertical height above the tread at its nosing of between 33 and 36 inches.

(l) For all types of stairways, the stair width shall be clear of all obstructions other than the handrails.

(m) Handrails and trim for all Types 1, 2, and 3 stairways shall be of approved "incombustible materials."

(n) For all types of stairways, there shall be no variation in the width of the stairs, the depth of the tread, or the height of the risers in any flight. Where variation in height of riser or depth of tread in different flights is necessary, such variations shall be minimized.

(o) For all types of stairways, the sum of the riser height and tread depth shall be at least 17 inches and not more than 18 inches. Types 1, 2, and 3 stairways having treads less than 10 inches in depth shall have a nosing of one inch or other means to provide additional room on the tread.

(p) All stairways shall be dimensioned in accordance with Table 72.05–20(p), depending upon the type of stairway and the number of persons served.

TABLE 72.05–20(p)

| Type of stairway | Primary use | Maximum angle of inclination (degrees) | Minimum stair tread width, in inches, based upon number of persons served by the stairway | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Number of persons | | | | | | |
| | | | 1–10 | 11–20 | 21–30 | 31–40 | 41–50 | 51–60 | Over 60 |
| 1 | Passenger or crew | 40 | 28 | 30 | 32 | 34 | 36 | 40 | 44 |
| 2 or 3 | Passenger | 40 | 28 | 30 | 32 | 34 | 36 | 36 | 36 |
| 2 or 3 | Crew | 50 | 28 | 30 | 30 | 30 | 30 | 30 | 30 |
| 4 | Passenger or embarkation route. | 45 | 28 | 30 | 30 | 30 | 30 | 30 | 30 |
| 4 | Crew | 55 | 24 | 24 | 24 | 24 | 24 | 24 | 24 |

(1) The maximum angle of inclination from the horizontal for any stairway shall be as given in Table 72.05–20(p).

(2) For all types of stairways, the minimum width shall be determined on a deck-by-deck basis. Except as further noted, on any particular deck, only those persons on that deck using the stairway are involved in the width determination. However, once a minimum required width has been established at any one level, that width may not be reduced at any subsequent deck level in the direction of normal escape. This does not prohibit the use of stair widths exceeding the required minimum for any particular flight or flights.

(3) The various spaces shall be considered to have the number of persons in them as follows:

(i) Passenger staterooms—designed capacity.

(ii) Crew staterooms—two-thirds designed capacity.

(iii) Theaters, dining halls, and similar spaces having fixed seating—maximum seating capacity.

(iv) Lounges, club rooms, etc.—1 person for every 20 square feet of deck area.

(v) Working spaces—normal operating capacity.

(4) Type 1 stairways shall be dimensioned on a deck-by-deck basis as described in the previous subparagraphs. In determining the number of persons using a Type 1 stairway, all persons within the Main Vertical Zone or Zones in question are assumed to be using Type 1 stairways. No consideration is given to any Type 2 or 3 stairways that may be available. If more than one Type 1 stairway serves a particular Main Vertical Zone, the persons shall be distributed between the stairways dependent upon the arrangements, and the stairways shall be dimensioned accordingly. If in the normal operation of the vessel, a Type 1 stairway is intended for a greater number of persons than given by the foregoing, the larger number shall be used.

(5) Types 2, 3, and 4 stairways shall be dimensioned on a deck-by-deck basis as described in this paragraph. In determining the number of persons using the stairways, the normal operation of the vessel shall be the determining factor. In this respect, if any particular stairway forms part of a normal debarkation route, the number of persons using the stairway for that purpose shall be considered.

(q) All types of stairways designed with a broken flight between any two decks shall conform to the additional requirements of this paragraph.

(1) Any interruption of the slope or change of direction of the stairway shall be accomplished by means of an intermediate landing of rectangular or nearly rectangular shape based on the actual dimensions of the stairs landing thereon.

(2) Each set of stairs of a broken flight shall be dimensioned independently, and shall conform to the minimum stair widths given in Table 72.05–20(p).

(r) Landings for stairways shall be provided in accordance with the applicable requirements of this paragraph.

(1) For all types of stairways, at the top and bottom of each flight of stairs, there shall be a clear landing having an area at least equal to the square of the actual stair tread width.

(2) For Type 1 stairways, there shall be provided within the enclosure at each deck level a landing having a minimum clear area in square feet, exclusive of the stairs, equal to 1.2 times the number of persons from that deck using the stairway.

(3) Where an aisle around a stairway is required due to the relationship of the flights, such aisle shall have a clear width at all points at least equal to the actual stair tread width.

(s) The total clear width of doors to stairways shall be as set forth in Table 72.05–20(s), and shall meet all of the other applicable requirements of this paragraph.

TABLE 72.05-20(s)

| Type of stairway | Primary use | Minimum clear opening, in inches, of doors to stairways based on number of persons served by doors | | | | | |
|---|---|---|---|---|---|---|---|
| | | Number of persons (*N*) | | | | | |
| | | 1-10 | 11-20 | 21-30 | 31-40 | 41-50 | Over 50 |
| 1 | Passenger or crew | 28 | 30 | 31 | 34 | 36 | [1] 0.75*N* |
| 2 or 3 | Passenger | 28 | 30 | 32 | 34 | 35 | 35 |
| 2 or 3 | Crew | 28 | 30 | 30 | 30 | 30 | 30 |

[1] Obtain clear opening in inches by multiplying the number of persons served (*N*) by 0.75.

(1) The dimensioning of doors shall be based on the same fundamentals as described in subparagraphs (p)(2) through (5) of this section for stairways. However, the number of people involved for a particular door shall be determined from the arrangements, each door being calculated independent of any other doors to the stairway at the same level.

(2) In no case shall a clear door width be less than 28 inches.

(3) On the Embarkation Deck, each Type 1 stairway shall provide at least 44 inches of exit door width to each side of the vessel. Exit may be provided directly to the weather or indirectly by passageways and/or corridors which lead to the weather.

**§ 72.05-25 Doors, other than watertight.**

(a) The general requirement for doors, other than watertight doors, are as follows:

(1) All doors shall be capable of operation from either side by 1 person.

(2) In public spaces, stairway enclosures, corridors, etc., all doors shall open in the direction of escape where practicable.

(3) If it is desired to use decorative doors in addition to those required, they shall be constructed of approved incombustible materials and shall not interfere with the normal operation of the required doors, and shall open in the same direction if the required doors are in a main avenue of escape.

(4) For the purpose of this subpart, all glass permitted in doors shall be at least ¼-inch thick. However, greater thickness may be required for strength purposes in certain locations. Except for hardwood doors permitted by subparagraph (b)(8) of this section, all glass shall be fitted in steel or equivalent metal frames and shall be retained by steel or equivalent metal glazing beads or angles.

(5) Where wire-inserted glass is required, and the single wire type is employed, the strands shall run horizontally and shall be not more than 2 inches apart.

(6) Where hose ports are fitted, they shall be cut in the lower corner of the door on the side opposite the hinge so that if the hose is passed through the doorway when the door is open, it may be closed over the hose. The cut for the hose port should be approximately 6 inches square. A hinged or pivoted steel or equivalent metal cover shall be fitted in the cut, equipped with a bullet catch or similar method of fastening which will permit easy and automatic operation of the hinged cover.

(7) Combustible veneers may be used in doors where permitted for, and subject to the same conditions as, the bulkheads in which the doors are hung.

(8) The locking of doors may be permitted, except as noted in § 72.10-20.

(b) Doors in "A" Class bulkheads shall meet the following requirements:

(1) Doors in bulkheads required to be Class A-60, A-30, or A-15 shall be of hollow steel or equivalent metal construction solidly filled with approved structural insulation capable of meeting the requirements for a Class A-15 bulkhead.

(2) Doors in bulkheads required to be Class A-0 shall be of solid or hollow steel or equivalent metal construction capable of meeting the requirements of a Class A-0 bulkhead.

(3) Doors shall have a latch with a minimum throw of ¾ inch which can be operated from either side of the door. Double swing doors, where permitted for the proper utility of the space, may have the latch normally inoperative.

(4) Except as noted in subparagraph (8) of this paragraph, doors may be fitted with not more than 100 square inches of glass, which shall be of the wire inserted type.

(5) Vent grilles or louvers shall not be used in doors of this type.

(6) The bottoms of doors may be undercut not to exceed ½ inch above the door sill or top of approved deck covering. Rugs, and carpets, shall not pass through doorways, but linoleum and similar coverings may do so.

(7) Door frames shall be of rigid construction, and shall provide at least a ½ inch door stop at the sides and top, except:

(i) Double doors capable of independent operation and latching may have a clearance between the doors not to exceed ⅛ inch. However, if one door must always be closed first, a doorstop of at least ½ inch shall be provided for the second door.

(ii) Double swing doors, where permitted, may have a maximum clearance of ⅛ inch at the tops and sides.

(8) Doors opening out onto open decks shall either meet the applicable requirements of this paragraph, or they may be of hardwood having a minimum thickness of 1¾ inches. In any case, no restriction as to the area of glass will be made for such doors insofar as this subpart is concerned. Only glass of the wire-inserted type may be fitted in such doors opening onto safety areas from accommodation spaces containing combustible type furniture and service, cargo, and machinery spaces.

(9) Doors in stairway enclosures and Main Vertical Zone bulkheads shall, in addition to meeting the requirements of this paragraph, also meet the following requirements:

(i) Doors, other than those which are normally locked, such as from staterooms, fan rooms, lockers, etc., shall be of the self-closing type capable of closing against a 3½ degree list, and such doors shall be numbered in accordance with § 78.47-35 of this subchapter.

(ii) All doors, except those that are kept normally closed, shall be of a type which are capable of release from the control station and from a position at the door. The release mechanism shall be so designed that the door will automatically close in the event of disruption to the control system; however, approved power operated watertight doors will be considered acceptable for this purpose. Holdback hooks, or other means of permanently holding the door open, not subject to control station release, will not be permitted. When double swing doors are permitted, they shall have a latch arrangement which is automatically engaged by the operation of the door release system.

(iii) Double doors shall be so arranged that either door may be closed and latched independently.

(iv) For additional requirements for stairway doors, see § 72.05-20(s).

(c) Doors in "B" Class bulkheads shall meet the following requirements:

(1) Doors may be of solid or hollow steel or equivalent metal construction or may be of steel or equivalent metal frame with glass panes or may be of approved incombustible materials of such construction as specifically approved by the Commandant.

(2) No restriction as to the area of glass will be made for such doors, but all glass shall be of the wire-inserted type.

(3) The lower half of such doors may contain vent grilles or louvers with a net area not to exceed 2 square feet.

(4) Doors shall have a latch with a minimum throw of ⅜ inch which can be operated from either side of the door. Double swing doors, where permitted for the proper utility of the space, may have the latch normally inoperative.

(5) The bottoms of doors may be undercut not to exceed 1 inch above the door sill or top of approved deck covering. Rugs and carpets shall not pass through doorways but linoleum and similar covering may do so.

(6) Door frames shall be of rigid construction, and shall provide at least a ½ inch doorstop at the sides and top, except:

(i) Double doors capable of independent operation and latching may have a clearance between the doors not to exceed ⅛ inch. However, if one door must

always be closed first, a door stop of at least ½ inch shall be provided for the second door.

(ii) Double swing doors, where permitted, may have a maximum clearance of ⅛ inch at the tops and sides.

(d) Doors in bulkheads required to be Class C shall be of approved incombustible materials.

**§ 72.05–30 Windows and airports.**

(a) For the purpose of this subpart, all glass in windows or airports shall be at least ¼ inch thick. However, greater thickness may be required for strength purposes in certain locations. All glass shall be fitted in steel or equivalent metal frames and shall be retained by steel or equivalent metal glazing beads or angles.

(b) Where wire-inserted glass is required, and the single wire type is employed, the strands shall run horizontally and shall be not more than 2 inches apart.

(c) Windows in Class B–0 bulkheads shall be fitted with wire inserted glass. Such windows opening onto passageways may not extend below the normal height of the storm rails.

(d) Windows in Class B–15 bulkheads shall be fitted with wire inserted glass. In addition, such windows shall be fitted with a suitable steel or equivalent metal shutter capable of being operated manually as well as automatically by means of a fusible link.

(e) Windows in interior "A" Class bulkheads shall be fitted with suitable steel or equivalent metal shutter capable of being operated manually as well as automatically from the control station by the same system used for the fire doors as noted in § 72.05–25(b)(9)(ii). The metal shutter shall be insulated to meet the applicable bulkhead requirements.

(f) Windows or air ports opening onto lifeboat embarkation or lowering spaces from service, cargo, or machinery spaces, or from control or accommodation spaces other than those containing only incombustible veneers and trim and fire resistant furnishings, shall be fitted with wire inserted glass. Other windows or air ports opening onto open decks or enclosed promenades need not have wire inserted glass.

(g) Skylights to spaces containing auxiliary internal combustion machinery having an aggregate horsepower of 1,000 or more, and to boiler and main enginerooms, shall be capable of being closed from outside the space. If glass is fitted in such skylights, it shall be of the wire inserted type. The glass panels shall be fitted with permanently attached shutters of steel or equivalent metal.

**§ 72.05–35 Hatch covers and shifting boards.**

(a) Wood hatch covers may be used between cargo spaces. Hatch covers in other locations shall meet the requirements for deck construction noted in Tables 72.05–10 (f) and (g).

(b) Tonnage openings in "A" Class bulkheads shall be closed by means of steel plates.

**§ 72.05–40 Insulation, other than for structural fire protection.**

(a) Any insulation installed for heat and comfort, refrigeration (including air conditioning), or for any other purpose, and all material incidental to its installation, shall be approved Incombustible Materials. This paragraph shall not apply to such insulation installed in cargo spaces, refrigerated storerooms, individual refrigerator boxes, nor to pipe and machinery coverings or laggings within the machinery spaces.

**§ 72.05–45 Paint.**

(a) An excessive number of coats of paint will be discouraged unless noncombustible paint is used.

(b) Nitrocellulose or other highly flammable or noxious fume-producing paints or lacquers shall not be used.

**§ 72.05–50 Ventilation.**

(a) Where the term "duct" is used in this section, it shall include trunks, plenums, and any other type of ventilation piping, chambers, or duct work.

(b) Where automatic fire dampers are required, they shall be designed to operate at approximately 165 degrees F. for normal locations, and approximately 212 degrees F. for locations such as galleys. The dampers shall be so designed as to close against the anticipated draft in the duct. The damper shall be made accessible for periodic inspection by means of a hinged or bolted plate in the duct. The damper and the portion of duct containing the damper shall be constructed of at least ⅛ inch steel plate suitably stiffened. No insulation need be applied to the damper blade.

(c) Where ventilation ducts are required to meet bulkhead requirements, the space within the duct shall be considered to be the same as the space served by the ventilator, and the duct shall be insulated to meet the applicable requirements of Tables 72.05–10 (d) and 72.05–10(e).

(d) All ventilation systems shall be designed, where practicable, so that all ducts leading to the various enclosures are kept within the main vertical zones. No duct may serve spaces in more than one main vertical zone.

(e) Where of necessity, ducts pass through main vertical zone bulkheads, automatic fire dampers shall be fitted adjacent to the bulkhead. The duct between the bulkhead and the damper shall meet the applicable bulkhead requirements. The damper shall be fitted on at least one side of the bulkhead with a visible indicator showing whether the damper is in the open or closed position. The indicator may be connected to the manual operating device rather than the damper blade so that it might show as being open when it had automatically closed, but could never be open if the indicator showed it to be closed. The damper shall be capable of being manually closed from both sides of the bulkhead. The operating positions for the damper shall be marked as required by § 78.47–53 of this subchapter.

(f) Vent ducts serving stairway enclosures shall serve no other spaces.

(g) Ventilation ducts serving cargo or main machinery spaces which pass through accommodation spaces or safety areas shall be fitted with an automatic fire damper adjacent to the point of entry. Between the bulkhead or deck and the damper, and in addition, on vertical ducts for a distance of 6 feet above the damper, the duct shall meet the applicable bulkhead requirements.

(h) Exhausts from galleys shall meet the applicable bulkhead requirements. In addition, an automatic damper shall be installed in exhaust ducts over frying vats, etc.

(i) In all ventilation systems, manually operated dampers or other suitable means shall be provided in accessible locations, outside the spaces served by the system, for shutting off the passage of air in the event of fire; however, no dampers shall be placed in exhaust ducts from film lockers or projection rooms.

(j) For information regarding controls of electrically powered ventilation systems, see Subchapter J (Electrical Engineering) of this chapter.

**§ 72.05–55 Furniture and furnishings.**

(a) For the purpose of this subpart, rooms containing "fire resistant furnishings" will be considered to be those in which:

(1) All case furniture such as desks, wardrobes, dressing tables, bureaus, dressers, etc., shall be constructed entirely of approved incombustible materials; except that a combustible veneer not exceeding ⅛ inch may be used on the top surface of such articles.

(2) All free standing furniture such as chairs, sofas, tables, etc., shall be constructed with frames of approved incombustible materials.

(3) All draperies shall be of approved fire resistant fabrics.

(4) All rugs and carpets shall be of wool or other material having equivalent fire resistive qualities.

(b) Waste paper baskets shall be constructed of approved incombustible materials with solid sides and bottoms.

(c) Passageways and stairway enclosures shall contain only fire resistant furnishings. In addition, all upholstery and padding of chairs, sofas, etc., in these areas, shall be of approved fire resistant materials.

**§ 72.05–60 Motion picture projection and equipment.**

(a) Inasmuch as only acetate or slow burning film may be used, projection rooms and special film stowage rooms are not required.

**§ 72.05–90 Vessels contracted for prior to May 26, 1965.**

(a) Vessels of less than 100 gross tons on an international voyage, contracted for prior to November 19, 1952, shall meet the following requirements:

(1) Existing structure, arrangements, and materials previously approved will be considered satisfactory so long as they meet the minimum requirements of this paragraph and they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standard as the original construction.

(b) Vessels of 100 gross tons and over, contracted for prior to May 28, 1936, shall meet the following requirements:

(1) Existing structure, arrangements, and materials previously approved will be considered satisfactory so long as they meet the minimum requirements of this paragraph and are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standards as the original construction.

(2) All vessels in ocean or coastwise service shall be fitted above the bulkhead deck with fire-resisting bulkheads and doors spaced not more than 131 feet apart which are capable of resisting the passage of flame for a period of at least 1 hour.

(3) All vessels with berth or stateroom accommodations for 50 or more passengers shall be fitted with an approved automatic sprinkling system unless deemed unnecessary by the Commandant. This system shall be so installed as to protect all enclosed parts of the vessel accessible to passengers or crew while the vessel is being navigated, except cargo holds, machinery spaces, and when of fire-resisting construction, toilets, bathrooms, and spaces of similar construction. Where, in the case of particular vessel, the Commandant does not consider the installation of an automatic water-sprinkling system necessary, such vessel shall be protected in such enclosed parts of the vessel as the Commandant shall deem necessary, with an automatic electric or pneumatic fire-detecting and alarm system, used singly or in combination, of a type approved by the Commandant.

(c) The provisions of this paragraph shall apply to vessels of 100 gross tons and over contracted for on or after May 28, 1936, but prior to May 26, 1965; and to vessels of less than 100 gross tons which are on international voyages and which were contracted for prior to May 26, 1965.

(1) Existing structure, arrangements, and materials previously approved will be considered satisfactory so long as they meet the minimum requirements of this paragraph and are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standards as the original construction.

(2) The details shall be in general agreement with §§ 72.05–5 through 72.05–60 insofar as is reasonable and practicable.

(d) Vessels of less than 100 gross tons and not on an international voyage which carry more than 150 passengers, and which were contracted for prior to May 26, 1965, shall meet the following requirements:

(1) Existing structure, arrangements, and materials previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standards as the original construction.

## Subpart 72.10—Means of Escape

### § 72.10–1 Application.

(a) The provisions of this subpart, with the exception of § 72.10–90, shall apply to all vessels contracted for on or after November 19, 1952. Vessels contracted for prior to November 19, 1952, shall meet the requirements of § 72.10–90.

### § 72.10–5 Two means required.

(a) There shall be at least two means of escape from all general areas accessible to the passengers or where the crew may be quartered or normally employed. At least one of these two means of escape shall be independent of watertight doors. For stairway continuity and general requirements for stairways on any vessel of 100 gross tons and over, or any vessel which carries more than 150 passengers, or any vessel on an international voyage, see § 72.05–20.

(b) Elevators shall not be considered as one of the required means of escape.

(c) Stairways serving only a space and a balcony to a space shall not be considered as one of the required means of escape.

### § 72.10–10 Location.

(a) The two means of escape shall be as remote as practicable so as to minimize the possibility of one incident blocking both escapes.

### § 72.10–15 Vertical ladders not acceptable.

(a) Verticle ladders and deck scuttles shall not in general be considered satisfactory as one of the required means of escape. However, where it is demonstrated that the installation of a stairway would be impracticable, a vertical ladder may be used as the second means of escape.

### § 72.10–20 No means for locking door.

(a) No means shall be provided for locking doors giving access to either of the 2 required means of escape, except that crash doors or locking devices, capable of being easily forced in an emergency, may be employed provided a permanent and conspicuous notice to this effect is attached to both sides of the door. This paragraph shall not apply to outside doors to deckhouses where such doors are locked by key only and such key is under the control of one of the vessel's officers.

### § 72.10–25 Stairway size.

(a) Stairways shall be of sufficient width to satisfactorily accommodate the number of persons having access to such stairs for escape purposes.

### § 72.10–30 Dead end corridors.

(a) Dead end corridors, or the equivalent, more than 40 feet in length shall not be permitted.

### § 72.10–35 Public spaces.

(a) In all cases, public spaces having a deck area of over 300 square feet shall have at least two exits. Where practicable, these exits shall give egress to different corridors, rooms, or spaces to minimize the possibility of one incident blocking both exits.

### § 72.10–40 Access to lifeboats.

(a) The stairways, corridors, and doors shall be so arranged as to permit a ready and direct access to the various lifeboat embarkation areas.

### § 72.10–45 Weather deck communications.

(a) Vertical communication shall be provided between the various weather decks by means of permanent inclined ladders. Where ladders are for the exclusive use of the crew for rapid communication, and do not form part of a normal escape route, vertical ladders may be employed.

### § 72.10–90 Vessels contracted for prior to November 19, 1952.

(a) Existing arrangements previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standards as the original design provided that in no case will a greater departure from the standards of §§ 72.10–5 through 72.10–45 be permitted than presently exists. Nothing in this paragraph shall be construed as exempting any vessel from having 2 suitable means of escape from all main compartments which are accessible to the passengers or where the crew are normally quartered or employed.

## Subpart 72.15—Ventilation

### § 72.15–1 Application.

(a) The provisions of this subpart with the exception of § 72.15–90, shall apply to all vessels contracted for on or after November 19, 1952. Vessels contracted for prior to November 19, 1952, shall meet the requirements of § 72.15–90.

### § 72.15–5 Structural fire protection.

(a) See § 72.05–50 for ventilation requirements on vessels of 100 gross tons and over or vessels of any tonnage on an international voyage, pertaining to structural fire protection.

### § 72.15–10 Vessels using fuel having a flashpoint of 110 degrees F. or lower.

(a) Where liquid fuel having a flashpoint of 110 degrees F. or lower is used for main or auxiliary machinery or for starting purposes, the spaces containing such machinery or fuel tanks shall have natural supply and mechanical ventilation as required by this section.

(b) The requirements for the mechanical exhaust system shall be such as to assure the air changes as noted in Table

72.15–10 (b), depending upon the size of the space.

TABLE 72.15–10 (b)

| Size of space, cubic feet | | Minutes per air change |
|---|---|---|
| Over | Not over | |
| --- | 500 | 2 |
| 500 | 1,000 | 3 |
| 1,000 | 1,500 | 4 |
| 1,500 | --- | 5 |

(c) Exhaust blower motors shall be outside of the ducts, and if mounted in any compartment required to be ventilated by this section, shall be of the explosion proof type. Blower blades shall be non-sparking with reference to their housings.

(d) Exhaust blower switches shall be located outside of any space required to be ventilated by this section, and shall be of the type interlocked with the ignition switch so that the blowers are started before the engine ignition is switched on. A red warning sign at the switch shall state that the blowers shall be operated prior to starting the engines for a sufficient time to insure at least one complete change of air in the compartments.

(e) The area of the ducts shall be such as to limit the air velocity to a maximum of 2,000 feet per minute. Ducts may be of any shape, provided that in no case shall 1 dimension exceed twice the other.

(f) At least 2 inlet ducts shall be located at 1 end of the compartment and they shall extend to the lowest part of the compartment or bilge on each side. Similar exhaust ducts shall be led to the mechanical exhaust system from the lowest part of the compartment or bilge on each side of the compartment at the end opposite from that at which the inlet ducts are fitted.

(g) All ducts shall be constructed of non-ferrous metal or galvanized ferrous metal not less than No. 22 USSG, intact and gastight from end to end and shall be of substantial construction. The ducts shall lead as direct as possible and be properly fastened and supported.

(h) All supply ducts shall be provided with cowls or scoops having a free area not less than twice the required duct area. When the cowls or scoops are screened, the mouth area shall be increased to compensate for the area of the screen wire. Dampers shall not be fitted in the supply ducts. Cowls or scoops shall be kept open at all times except when the stress of weather is such as to endanger the vessel if the openings are not temporarily closed. Supply and exhaust openings shall not be located where the natural flow of air is unduly obstructed, or adjacent to possible sources of vapor ignition, nor shall they be so located that exhaust air may be taken into the supply vents.

**§ 72.15–15 Ventilation for closed spaces.**

(a) All enclosed spaces within the vessel shall be properly vented or ventilated. Means shall be provided to close off all vents and ventilators.

(b) Means shall be provided for stopping all fans in ventilation systems serving machinery and cargo spaces and for closing all doorways, ventilators and annular spaces around funnels and other openings to such spaces, from outside these spaces, in case of fire.

**§ 72.15–20 Ventilation for crew quarters and passenger spaces.**

(a) All crew and passenger spaces shall be adequately ventilated in a manner suitable to the purpose of the space.

(b) On vessels of 100 gross tons and over, except for such spaces as are so located that under all ordinary conditions of weather, windows, ports, skylights, etc., and doors to passageways can be kept open, all crew spaces shall be ventilated by a mechanical system, unless it can be shown that a natural system will provide adequate ventilation. However, vessels which trade regularly in the tropics shall, in general, be fitted with a mechanical ventilation system.

**§ 72.15–90 Vessels contracted for prior to November 19, 1952.**

(a) Existing arrangements previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standards as the original design provided that in no case will a greater departure from the standards of §§ 72.15–5 through 72.15–20 be permitted than presently exists.

## Subpart 72.20—Accommodations for Officers and Crew

**§ 72.20–1 Application.**

(a) The provisions of this subpart, with the exception of § 72.20–90, shall apply to all vessels of 100 gross tons and over contracted for on or after November 19, 1952. Vessels of 100 gross tons and over contracted for prior to November 19, 1952, shall meet the requirements of § 72.20–90.

(b) Vessels of less than 100 gross tons shall meet the applicable requirements of this subpart insofar as is reasonable and practicable.

**§ 72.20–5 Intent.**

(a) It is the intent of this subpart that the accommodations provided for officers and crew on all vessels shall be securely constructed, properly lighted, heated, drained, ventilated, equipped, located, arranged, and where practicable, shall be insulated from undue noise and effluvia.

(b) The crew referred to in this subpart includes all persons, except the licensed officers, regularly employed on board any vessel. Where the requirements for the accommodations of licensed officers are not otherwise specified, they shall be at least equivalent to that indicated for the crew.

(c) For the purpose of this subpart, the term "crew spaces" shall include sleeping rooms, messrooms, recreational rooms, toilet and shower spaces, etc., which are intended for the exclusive use of the crew.

**72.20–10 Location of crew spaces.**

(a) Crew spaces shall be located, where practicable, so that the maximum amount of fresh air and light are obtainable, having due regard to the service of the vessel and the requirements of other space users.

(b) Crew quarters shall not be located farther forward in a vessel than a vertical plane located at 5 percent of the vessel's length abaft the forward side of the stem at the designed summer load water line. However, for vessels in other than ocean or coastwise service, this distance need not exceed 28 feet. For the purpose of this paragraph, the length shall be as defined in § 43.15–1 of Subchapter E (Load Lines) of this chapter. No section of the deck of the crew spaces shall be below the deepest load line, except that in special cases, the Commandant may approve such an arrangement: *Provided*, That in no case shall the deck head of the crew space be below the deepest load line.

(c) Hawse pipes or chain pipes shall not pass through crew spaces.

(d) There shall be no direct communication, except through solid, close fitted doors or hatches between crew spaces and chain lockers, cargo or machinery spaces.

(e) There shall be no access, vents, or sounding tubes from fuel or cargo oil tanks opening into crew spaces, except that sounding tubes and access openings may be located in corridors.

(f) Where practicable, crew spaces shall be located entirely separate and independent of spaces allotted to passengers or licensed officers.

**§ 72.20–15 Construction.**

(a) See subpart 72.05 for requirements on vessels of 100 gross tons and over or vessels of any tonnage on an international voyage pertaining to structural fire protection.

(b) All crew spaces are to be constructed in a manner suitable for the purpose for which they are intended. The bulkheads separating the crew space from cargo and machinery spaces, lamp and paint rooms, storerooms, drying rooms, washrooms, and toilet spaces shall be made odorproof where deemed necessary by the Commandant.

(c) Toilet spaces, except when provided as private or semiprivate facilities, shall be so built, fitted, and situated, that no odor from them will readily enter other crew spaces.

(d) Where shell or unsheathed weather decks form boundaries of crew spaces, suitable protective coverings shall be applied to prevent formation or accumulation of moisture.

(e) Where crew spaces adjoin or are immediately above spaces such as galleys, machinery spaces or casings, donkey boilerrooms, etc., they shall be suitably protected from the heat by approved insulation.

(f) The interior sides and deck heads of crew spaces shall be covered with enamel, paint, or other material light in color.

(g) Crew spaces shall be properly drained where considered necessary.

(h) All washrooms and toilet rooms shall be properly drained and so constructed and arranged that they can be kept in a clean, workable, and sanitary condition. The scuppers shall be located in the lowest part of the spaces, due consideration being given to the average trim of the vessel.

**§ 72.20–20 Sleeping accommodations.**

(a) *Arrangements.* (1) Separate sleeping accommodations are to be provided for the deck, engine, and steward groups of the crew.

(2) Each watch of seamen, firemen, or similar ratings on duty in watches is to be provided with separate sleeping room or rooms unless the total space for accommodations makes this impracticable.

(3) Where practicable, each licensed officer shall be provided with a separate stateroom.

(b) *Size.* (1) Sleeping accommodations for the crew shall be divided into rooms, no one of which shall berth more than 4 persons, except that on passenger ships requiring a large personnel in the steward's department, rooms may be arranged to accommodate not more than 10 such persons.

(2) Each room shall be of such size that there are at least 30 square feet of deck area and a volume of at least 210 cubic feet for each person accommodated, except where more than four persons are berthed in one room, in which case the minimum may be 24 square feet of deck area and a volume of 168 cubic feet for each person. The clear head room shall be not less than 6 feet 3 inches. In measuring sleeping quarters allocated to crews of vessels, any equipment contained therein for the use of the occupants is not to be deducted from the total volume or from the deck area.

(c) *Equipment.* (1) Each person shall have a separate berth and not more than 1 berth shall be placed above another. The berths shall have a framework of metal or other hard, smooth material not likely to corrode or harbor vermin, and shall be so arranged that they provide ample room for easy occupancy. The overall size of a berth shall not be less than 30 inches wide by 76 inches long, except by special permission of the Commandant. Where berths adjoin, they shall be divided by a partition not less than 18 inches in height. Where 2 tiers of berths are fitted, the bottom of the lower must not be less than 12 inches above the deck, and the bottom of the upper must not be less than 2 feet 6 inches both from the bottom of the lower and from the deck overhead. The berths shall not be obstructed by pipes, ventilating ducts, or other installations.

(2) A locker of metal or other hard, smooth material shall be provided for each person accommodated in a room. Each locker shall be not less than 300 square inches in cross section area and 60 inches high. It shall be so placed as to be readily accessible. The interior of the locker shall be so arranged as to facilitate the proper stowage of clothes.

**§ 72.20–25 Washrooms and toilet rooms.**

(a) There shall be provided at least 1 toilet, 1 washbasin, and 1 shower or bathtub for each 8 members or portion thereof in the crew to be accommodated. The crew to be accommodated shall include all members who do not occupy rooms to which private or semiprivate facilities are attached.

(b) Under the following conditions, the toilet and washing facilities for the specific groups of the crew indicated shall be located in spaces separate from the facilities for other crewmembers; and shall be provided for that group in the ratios required by paragraph (a) of this section.

(1) The members of the engine department, where their number, exclusive of licensed officers, and others separately provided for, exceeds eight.

(2) The members of the steward's department, exclusive of those separately provided for, where their number exceeds eight.

(3) All female members of the crew.

(c) The toilet rooms and washrooms shall be located convenient to the sleeping quarters of the crew to which they are allotted but shall not open directly into such quarters except when they are provided as private or semiprivate facilities.

(d) All washbasins, showers, and bathtubs shall be equipped with proper plumbing, including hot and cold running water. Washbasins may be located in the crew sleeping quarters.

(e) The toilet rooms shall be separate from the washrooms and at least 1 washbasin shall be fitted in each toilet room, except where private or semiprivate facilities are provided and washbasins are installed in sleeping rooms.

(1) All toilets shall be installed with proper plumbing for flushing. Toilets shall be provided with seats of the open front type. Urinals may be fitted in toilet rooms, if desired, but no reduction in the required number of toilets will be made therefor.

(2) Where more than one toilet is located in a space or compartment, each toilet shall be separated by partitions, which shall be open at the top and bottom for ventilation and cleaning purposes.

**§ 72.20–30 Messrooms.**

(a) Messrooms shall be located as near to the galley or suitably equipped serving pantries as is practicable except where messroom is equipped with a steam table. The messrooms shall be of such size as to seat the number of persons normally scheduled to be eating at one time.

(b) Messrooms shall be properly equipped with tables, seats, and other necessary equipment and shall be so arranged as to permit easy access to each seat.

**§ 72.20–35 Hospital space.**

(a) Each vessel, which in the ordinary course of its trade makes voyages of more than 3 days duration between ports and which carries a crew of 12 or more, shall be provided with a hospital space. This space shall be situated with due regard to the comfort of the sick so that they may receive proper attention in all weathers.

(b) The hospital shall be suitably separated from other spaces and shall be used for the care of the sick and for no other purpose.

(c) The entrance shall be of such width and in such a position as to admit a stretcher case readily. Berths shall be of metal and may be in double tier, provided the upper berth is hinged and arranged to be secured clear of the lower berth when not in use. At least one berth shall be so arranged that it can be made accessible from both sides when necessary.

(d) The hospital shall be fitted with berths in the ratio of 1 berth to every 12 members of the crew or portion thereof who are not berthed in single occupancy rooms, but the number of berths need not exceed 6.

(e) The hospital shall have a toilet, washbasin, and bathtub or shower conveniently situated. Other necessary suitable equipment of such character as clothes locker, table, seat, etc., shall be provided.

**§ 72.20–40 Other spaces.**

(a) Sufficient facilities, depending upon the number of the crew, shall be provided where the crew may wash their own clothes. There shall be at least 1 tub or sink, fitted with the necessary plumbing, including hot and cold running water.

(b) Clothes drying facilities or space shall be provided for the needs of the crew.

(c) A space or spaces of adequate size shall be available on an open deck to which the crew has access when off duty.

(d) Recreation accommodations shall be provided. Where messrooms are used for this purpose, they shall be suitably planned.

**§ 72.20–45 Lighting.**

(a) All crew spaces shall be adequately lighted in accordance with the requirements of Subchapter J (Electrical Engineering) of this chapter.

(b) Berth lights shall be provided for each member of the crew.

**§ 72.20–50 Heating.**

(a) All crew spaces shall be adequately heated in a manner suitable to the purpose of the space.

(b) The heating system will be considered satisfactory if it is capable of maintaining a minimum temperature of 70 degrees F. under normal operating conditions without undue curtailment of the ventilation.

(c) Radiators and other heating apparatus shall be so placed, and where necessary shielded, as to avoid risk of fire or danger or discomfort to the occu-

pants. Pipes leading to radiators or heating apparatus shall be lagged where the pipes create a hazard to persons occupying the space.

**§ 72.20–55 Insect screens.**

(a) Except in such areas as are considered to be insect free, provisions shall be made to protect the crew quarters against the admission of insects. This may be accomplished by the fitting of suitable screens to ventilating skylights, air ports, ventilators, and doors to unscreened spaces and the open deck, or by other methods.

**§ 72.20–90 Vessels contracted for prior to November 19, 1952.**

(a) Vessels of less than 100 gross tons, contracted for prior to November 19, 1952, shall meet the general intent of § 72.20–5 and in addition shall meet the following requirements:

(1) Existing structure, arrangements, materials, and facilities, previously accepted or approved will be considered satisfactory so long as they are maintained in a suitable condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standard as the original construction.

(b) Vessels of 100 gross tons and over, contracted for prior to March 4, 1915, shall meet the requirements of this paragraph.

(1) Existing structure, arrangements, materials, and facilities, previously approved will be considered satisfactory so long as they are maintained in a suitable condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standard as the original construction provided that in no case will a greater departure from the standards of §§ 72.20–5 through 72.20–55 be permitted than presently exists.

(c) Vessels of 100 gross tons and over, contracted for on or after March 4, 1915, but prior to January 1, 1941, shall meet the requirements of this paragraph.

(1) Existing structure, arrangements, materials, and facilities, previously accepted or approved will be considered satisfactory so long as they are maintained in a suitable condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standard as the original construction.

(2) Where reasonable and practicable, a minimum of 1 toilet, shower, and washbasin shall be provided for each 10 members of the crew or fraction thereof.

(3) Crew spaces shall have a volume of at least 120 cubic feet and a deck area of at least 16 square feet for each person accommodated.

(4) Each crewmember shall have a separate berth, and berths may not be placed more than two high.

(5) Each vessel, which in the ordinary course of its trade makes a voyage of more than 3 days' duration between ports and which carries a crew of 12 or more persons, shall be provided with a suitable hospital space for the exclusive use of the sick or injured. Berths shall be provided in the ratio of 1 berth for each 12 members of the crew or fraction thereof, but the number of berths need not exceed 6.

(6) The crew spaces shall be securely constructed, properly lighted, heated, drained, ventilated, equipped, located, and arranged, and where practicable shall be insulated from undue noise and effluvia.

(d) Vessels of 100 gross tons and over, contracted for on or after January 1, 1941, but prior to November 19, 1952, shall meet the requirements of this paragraph.

(1) Existing structure, arrangements, materials, and facilities, previously accepted or approved will be considered satisfactory so long as they are maintained in a suitable condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standard as the original construction.

(2) Washrooms and toilet rooms:

(i) There shall be a minimum of one toilet, shower, and washbasin for each eight members of the crew or fraction thereof who are not accommodated in rooms having attached private or semiprivate facilities.

(ii) Separate facilities shall be provided for the engineroom, deck, or stewards' department when the number of crew in that department, exclusive of officers, exceeds eight.

(iii) Toilet rooms shall be separate from the washrooms. At least one washbasin shall be installed in each toilet room.

(iv) Toilets shall be provided with seats of the open front type. Urinals may be fitted in toilet rooms, if desired, but no reduction will be made in the required number of toilets.

(v) Washbasins, showers, and bathtubs if substituted for showers, shall be equipped with proper plumbing, including hot and cold running water.

(3) Crew spaces shall have a volume of at least 120 cubic feet and a deck area of at least 16 square feet for each person accommodated.

(4) Each crewmember shall have a separate berth, and berths may not be placed more than two high.

(5) Each vessel, which in the ordinary course of its trade makes a voyage of more than 3 days' duration between ports and which carries a crew of 12 or more persons, shall be provided with a suitable hospital space for the exclusive use of the sick or injured. Berths shall be provided in the ratio of 1 berth for each 12 members of the crew or fraction thereof, but the number of berths need not exceed 6.

(6) The crew spaces shall be securely constructed, properly lighted, heated, drained, ventilated, equipped, located, and arranged, and where practicable shall be insulated from undue noise and effluvia.

## Subpart 72.25—Passenger Accommodations

**§ 72.25–1 Application.**

(a) The provisions of this subpart shall apply to all vessels.

**§ 72.25–5 Steerage passengers.**

(a) Where the total area provided for the exclusive use of a class of passengers is less than 36 square feet per passenger, the provisions of the Steerage Passenger Act of August 2, 1882, as amended, 46 U. S. C. 151, which is administered and enforced by the Bureau of Customs, shall be complied with, for any vessel engaged in a voyage from any port or place in the United States to any port or place in a foreign country or dominion (ports and places in foreign territory contiguous to the United States excepted) or conversely. For the purpose of computing the number of passengers, children under 1 year of age shall not be counted, and two children between the ages of one and eight shall be counted as one passenger.

**§ 72.25–10 Location of passenger quarters.**

(a) The deck forming the deckhead of passenger quarters between adjacent watertight bulkheads shall not be below the deepest load line at any point within the watertight compartment in question.

**§ 72.25–15 Passenger accommodations for excursion boats, ferryboats, and passenger barges.**

(a) Except as specifically excluded by this section, separate public toilet spaces shall be provided for male and female passengers with at least the minimum equipment in each based upon the number of passengers permitted to be carried as set forth in Table 72.25–15(a).

TABLE 72.25–15 (a)

| Number of passengers | | Toilets | Washbasins |
|---|---|---|---|
| Over | Not over | | |
| ------- | 100 | 1 | 1 |
| 100 | 200 | 2 | 1 |
| 200 | 300 | 3 | 2 |
| 300 | 1,000 | 4 | 2 |
| 1,000 | 1,500 | 5 | 3 |
| 1,500 | 2,000 | 6 | 3 |
| 2,000 | 2,500 | 7 | 4 |
| 2,500 | 3,000 | 8 | 4 |
| 3,000 | 3,500 | 9 | 5 |
| 3,500 | 4,000 | 10 | 5 |
| 4,000 | --------- | (1) | (1) |

(1) Additional facilities by extrapolation.

(b) In the men's spaces, urinals may be substituted for toilets, provided at least one-half the required toilets are fitted.

(c) On ferry boats and barges having a short run, passenger toilet facilities need not be fitted.

## Subpart 72.40—Rails and Guards

**§ 72.40–1 Application.**

(a) The provisions of this subpart, with the exception of § 72.40–90, shall apply to all vessels contracted for on or

after November 19, 1952. Vessels contracted for prior to November 19, 1952, shall meet the requirements of § 72.40–90.

**§ 72.40–5 Where rails required.**

(a) Rails or equivalent protection shall be installed near the periphery of all weather decks accessible to passengers or crew. The height and construction of such rails shall be as required by this section. The courses of the rails shall be approximately evenly spaced, and on vessels contracted for on or after January 1, 1955, the space between rail courses shall not exceed 18 inches.

(b) Such rails on decks accessible to passengers shall be in at least three courses and shall be at least 42 inches high, except:

(1) Where the height of the rails interferes with the business of the vessel, as in the case of a sport fishing vessel, other arrangements may be specifically approved by the Commandant: *Provided*, That in general the effective rail or bulwark height above the deck on which the passengers stand shall be at least 30 inches.

(c) On the passenger decks of ferry boats, excursion vessels, and vessels of a similar type, the space below the top of the rail shall be fitted with suitable wire mesh or the equivalent. Depending upon the type of construction, the lower rail courses may not be required.

(d) All other such rails shall be at least 36 inches high and shall be in at least three courses, approximately evenly spaced, except that on vessels contracted for prior to January 1, 1957, the rails may be in two courses.

**§ 72.40–10 Storm rails.**

(a) Suitable storm rails shall be installed in all passageways and at the deckhouse sides where passengers or crew might have normal access. Storm rails shall be installed on both sides of passageways which are 6 feet or more in width.

**§ 72.40–15 Vehicular ferries.**

(a) On vehicular ferries, suitable chains, cables, or other barriers shall be installed at the ends of the vehicle runways. In addition, suitable gates, rails, or other devices shall be installed as a continuation of the regularly required rails.

**§ 72.40–20 Guards in dangerous places.**

(a) Suitable covers, guards, or rails shall be installed in way of all exposed and dangerous places such as gears, machinery, etc.

**§ 72.40–90 Vessels contracted for prior to November 19, 1952.**

(a) Existing structure, arrangements, materials, and facilities previously approved will be considered satisfactory so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standards as the original construction provided that in no case will greater departure from the standards of §§ 72.40–5 through 72.40–20 be permitted than presently exists.

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# PART 73—WATERTIGHT SUBDIVISION

Subpart 73.01—Application

Sec.
73.01–1 General.

Subpart 73.05—Definitions

73.05–1 Subdivision load line.
73.05–2 Deepest subdivision load line.
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Subpart 73.90—Vessels Contracted for Prior to May 26, 1965

73.90–1 Requirements.

AUTHORITY: The provisions of this Part 73 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4417, as amended, 4418, as amended, 4426, as amended, 4488, as amended, 4490, as amended, sec. 3, 24 Stat. 129, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, sec. 2, 45 Stat. 1493, as amended, sec. 2, 49 Stat. 888, as amended, sec. 5, 49 Stat. 1384, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 391, 392, 404, 481, 482, 483, 395, 363, 85a, 88a, 369, 367, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857; 167–48, Oct. 19, 1962, 27 F.R. 10504.

## Subpart 73.01—Application

**§ 73.01–1 General.**

(a) The provisions of this part, with the exception of Subpart 73.90, shall apply to all vessels contracted for on or after May 26, 1965. Vessels contracted for prior to May 26, 1965, shall meet the requirements of Subpart 73.90.

(b) The provisions of this part shall apply to vessels subject to the act of May 10, 1956 (46 U. S. C. 390–390g), in accordance with the policies stated in § 70.05–15 of this subchapter.

## Subpart 73.05—Definitions

**§ 73.05–1 Subdivision load line.**

(a) A subdivision load line is a waterline used in determining the subdivision of the ship.

**§ 73.05–2 Deepest subdivision load line.**

(a) The deepest subdivision load line is the waterline which corresponds to the greatest draft permitted by the subdivision requirements which are applicable.

**§ 73.05–3 Length of the vessel.**

The length of the vessel is the length measured between perpendiculars taken at the extremities of the deepest subdivision load line.

**§ 73.05–4 Breadth of the vessel.**

The breadth of the vessel is the extreme width from outside of frame to outside of frame at or below the deepest subdivision load line. On wood vessels, measurements should be taken to outside of planking.

**§ 73.05–5 Bulkhead deck.**

The bulkhead deck is the uppermost deck up to which the transverse watertight bulkheads are carried.

**§ 73.05–6 Margin line.**

(a) The margin line is a line drawn at least 3 inches below the upper surface of the bulkhead deck at side where the bulkhead deck is continuous; where the bulkhead deck is not continuous, an assumed continuous margin line shall be used which at no point is less than 3 inches below the top of the deck at side to which the bulkheads concerned and the shell are carried watertight.

(b) In the case of vessels with continuous bulkhead decks, where the average value of the sheer at bow and stern is less than 12 inches, a modified margin line 3 inches below the top of deck at the ends but lowered amidships to the position indicated in Table 73.05–6(b) is to be used.

TABLE 73.05-6(b)

| Average value of sheer at bow and stern (inches) | Required position of margin line below top of deck, at side, amidships (inches) |
|---|---|
| 12 | 3 |
| 6 | 6 |
| 0 | 9 |

(1) Interpolation is required for intermediate values not shown in Table 73.05–6(b).

(2) The modified margin line shall be parabolic through the midship and end points indicated in this paragraph. Margin lines so determined are based upon the assumption that the bulkhead deck is continuous and has existing parabolic sheer. Where this is not the case, the margin line shall be such as to give at least a standard of safety equivalent to the standard described in this paragraph.

**§ 73.05–7 Draft.**

The draft is the vertical distance from the molded base line amidships to the subdivision load line in question.

**§ 73.05–8 Permeability.**

The permeability of a space is the percentage of that space which can be occupied by water.

**§ 73.05–9 Volume.**

The volume of a space which extends above the margin line shall be measured only to the height of that line. In all cases, volumes shall be calculated to molded lines; linear dimensions are to be taken in feet and volumes in cubic feet.

**§ 73.05–10 Machinery space.**

(a) The machinery space is to be taken as extending from the molded base line to the margin line and between the extreme main transverse watertight bulkheads bounding the spaces containing the main and auxiliary propelling machinery, boilers serving the needs of propulsion, and all permanent coal bunkers. In the case of unusual arrangements the Commandant may define the limits of the machinery space.

**§ 73.05–11 Passenger spaces.**

(a) Passenger spaces are those which are provided for the accommodation and use of passengers, excluding baggage, store, provision and mailrooms. However, for the purpose of § 73.10–5, crew spaces and all other spaces which, in the full load condition, normally contain no substantial quantity of cargo, coal, oil fuel, baggage, stores, provisions, or mail are to be treated as passenger spaces.

**§ 73.05–12 Floodable length.**

The floodable length at a given point in the length of the vessel is the maximum portion of the length of the vessel, having its center at the point in question, which can be flooded without the vessel being submerged beyond the margin line. The floodable length at any point in the length of the vessel shall be determined by a method of calculation which takes into consideration the form, draft and other characteristics of the vessel, and based on the definite assumptions of permeability as set forth in §§ 73.10–5 or 73.15–1.

## Subpart 73.10—Rules for Subdivision—Vessels on International Voyages and Vessels of 150 Gross Tons and Over in Ocean or Coastwise Service

**§ 73.10–1 Application.**

(a) The provisions of §§ 73.10–3 through 73.10–60 apply to all vessels on international voyages and vessels of 150 gross tons and over in ocean or coastwise service with certain exceptions with respect to vessels on short international voyages and permitted under § 75.10–10 of this subchapter to carry a number of persons on board in excess of the lifeboat capacity provided.

(b) Section 73.10–65 gives the provisions applicable to these latter vessels, which carry a number of persons on board in excess of the lifeboat capacity provided.

**§ 73.10–3 General.**

(a) Vessels shall be as efficiently subdivided as is possible having regard to the nature of the service for which they are intended. The degree of subdivision shall vary with the length of the vessel and with the service, in such manner that the highest degree of subdivision corresponds with the ships of greatest length, primarily engaged in the carriage of passengers.

**§ 73.10–5 Permeability.**

(a) *General.* In determining the floodable length, a uniform average permeability shall be used throughout the whole length of each of the following portions of the vessel below the margin line:

(1) The machinery space.

(2) The portion forward of the machinery space.

(3) The portion aft of the machinery space.

(b) *Machinery space.* (1) The uniform average permeability throughout the machinery space shall be determined from the formula:

$$85+10\frac{(a-c)}{v} \qquad (1)$$

where:

$a$ = volume of the passenger spaces, as defined in § 73.05–11, which are situated below the margin line within the limits of the machinery space.

$c$ = volume of between deck spaces below the margin line within the limits of the machinery space which are appropriated to cargo, coal, or stores, except as provided by § 73.05–11.

$v$ = whole volume of the machinery space below the margin line.

(2) Where it is shown to the satisfaction of the Commandant, U.S. Coast Guard, that the average permeability, as determined by detailed calculation, is less than that given by the formula, the calculated value may be substituted. For the purposes of such calculation, the permeabilities of passenger spaces, as defined in § 73.05–11 shall be taken as 95, that of all cargo, coal, and store spaces as 60, and that of double-bottom, oil-fuel, and other tanks at such values as may be approved in each case by the Commandant.

(c) *Portion forward and aft of machinery space.* (1) The uniform average permeability throughout the portion of the vessel before or abaft the machinery space shall be determined from the formula:

$$63 \text{ plus } 35\frac{a}{v} \qquad (2)$$

where:

$a$ = volume of the passenger spaces, as defined in § 73.05–11, which are situated below the margin line before or abaft the machinery space.

$v$ = whole volume of the portion of the vessel below the margin line before or abaft the machinery space.

(d) *Other arrangements.* (1) In the case of unusual arrangements, the Commandant may allow, or require, a detailed calculation of average permeability for the portions before or abaft the machinery spaces. For the purpose of such calculations, the permeability of passenger spaces as defined in § 73.05–11, shall be taken as 95, that of spaces containing machinery as 85, that of all cargo, coal, and store spaces as 60, and that of double bottoms, oil fuel, and other tanks at such values as may be approved in each case by the Commandant.

(e) *'Tween deck compartment.* (1) If a 'tween deck compartment between two watertight transverse bulkheads contains any passenger or crew space, the whole of that compartment, less any

space completely enclosed within permanent steel bulkheads and appropriated to other purposes, shall be regarded as passenger space. If, however, the passenger or crew space in question is completely enclosed with permanent steel bulkheads, only the space so enclosed need be considered as passenger space.

**§ 73.10–10 Factor of subdivision.**

(a) The maximum permissible length of a compartment having its center at any point in the vessel's length is obtained from the floodable length by multiplying the latter by an appropriate factor called the factor of subdivision. Where the required factor of subdivision is .50 or less, the combined length of any two adjacent main compartments shall not exceed the floodable length.

(b) The factor of subdivision shall depend on the length of the vessel, and for a given length shall vary according to the nature of the service for which the vessel is intended. It shall decrease in a regular and continuous manner as the length of the vessel increases, and from a factor $A$, applicable to vessels primarily engaged in the carriage of cargo, to a factor $B$ applicable to vessels primarily engaged in the carriage of passengers.

(1) The variations of the factors $A$ and $B$ shall be expressed by the following formulas where $L$ is the length of the vessel in feet as defined in § 73.05–3:

$$A=\frac{190}{L-160}\text{ plus }0.18\ (L=392\text{ and upward}) \quad (1)$$

$$B=\frac{94}{L-85}\text{ plus }0.18\ (L=200\text{ and upward}) \quad (2)$$

**§ 73.10–15 Criterion of service.**

(a) For a vessel of given length the appropriate factor of subdivision shall be determined by the Criterion of Service Numeral (hereinafter called the "Criterion Numeral") as given by the following formula:

$$C_s=60\frac{M+2P}{V}+30{,}000\frac{N}{L^2} \quad (1)$$

where:

$C_s$ = the Criterion Numeral.
$L$ = length of the vessel in feet, as defined in § 73.05–3.
$M$ = the volume of the machinery space, as defined in § 73.05–10, with the addition thereto of the volume of any permanent oil fuel bunkers which may be situated above the inner bottom and before or abaft the machinery space.
$P$ = the whole volume of the passenger spaces below the margin line, as defined in § 73.05–11.
$V$ = the whole volume of the vessel below the margin line.
$N$ = number of passengers for which the vessel is to be certificated.

**§ 73.10–20 Formulas for factor of subdivision.**

(a) The subdivision abaft the fore peak of vessels 392 feet or more in length having a Criterion Numeral of 23 or less shall be governed by the factor $A$ given by § 73.10–10(b)(1), of those having a Criterion Numeral of 123 or more by the factor $B$ given by § 73.10–10(b)(1); and of those having a Criterion Numeral between 23 and 123 by the factor $F$ obtained by linear interpolation between the factors $A$ and $B$, using the formula:

$$F=A-\frac{(A-B)\times(C_s-23)}{100} \quad (1)$$

(b) The subdivision abaft the fore peak of vessels less than 392 feet, but not less than 200 feet in length, and having a Criterion Numeral equal to $S$, where

$$S=\frac{10904-25L}{48} \quad (2)$$

shall be governed by the factor unity; of those having a Criterion Numeral of 123 or more by the factor $B$ given by § 73.10–10(b)(1); and of those having a Criterion Numeral between $S$ and 123 by the factor obtained by linear interpolation between unity and the factor $B$, using the formula:

$$F=1-\frac{(1-B)\ (C_s-S)}{123-S} \quad (3)$$

(c) The subdivision abaft the fore peak of vessels less than 392 feet, but not less than 200 feet, in length and having a Criterion Numeral less than $S$, and of all ships less than 200 feet in length shall be governed by the factor unity, unless it is shown to the satisfaction of the Commandant to be impracticable to comply with this factor in any part of the vessel, in which case the Commandant may allow such relaxation as may appear to be justified having regard to all the circumstances.

**§ 73.10–23 Vessels especially required to have a factor of subdivision not more than 0.5.**

(a) Irrespective of the results of application of § 73.10–20, any vessel 430 feet in length or longer shall have a factor of subdivision of not more than 0.5 if the value of "$X$" as given by either of the following formulae is equal to or exceeds the values given in Table 73.10–23(a), whichever is the greater:

$$X=\frac{(M+2P)}{V}\text{ or }\frac{(M+2P_1)}{V+P_1-P}$$

where:

$M$ = the volume of the machinery space, as defined in § 73.05–10, with the addition thereto of the volume of any permanent oil fuel bunkers which may be situated above the inner bottom and before or abaft the machinery space.
$P$ = the whole volume of the passenger spaces below the margin line, as defined in § 73.05–11.
$V$ = the whole volume of the vessel below the margin line.
$P_1$ = $0.6LN$, but not more than the sum of $P$ and the whole volume of the actual passenger spaces above the margin line or $0.4LN$, whichever is less.
$L$ = length of the vessel in feet, as defined in § 73.05–3.
$N$ = number of passengers for which the vessel is to be certificated.

TABLE 73.10–23(a)

| L[1] | "X" |
|---|---|
| 430 | 1.336 |
| 440 | 1.285 |
| 450 | 1.230 |
| 460 | 1.174 |
| 470 | 1.117 |
| 480 | 1.060 |
| 490 | 1.002 |
| 500 | .944 |
| 510 | .885 |
| 520 | .826 |
| 530 | .766 |
| 540 | .706 |
| 550 | .645 |
| 554 and up | .625 |

[1] Interpolate for intermediate values.

**§ 73.10–25 Stepped bulkhead decks.**

(a) Where in a portion or portions of a vessel the watertight bulkheads are carried to a higher deck than in the remainder of the vessel, and it is desired to take advantage of this higher extension of the bulkheads in calculating the floodable length, separate margin lines may be used for each such portion of the ship provided:

(1) The sides of the vessel extend throughout the vessel's length to the deck corresponding to the upper margin line and all openings in the shell plating below this deck throughout the length of the vessel meet the conditions for side openings below the margin line.

(2) The two compartments adjacent to the "step" in the bulkhead deck shall each be within the permissible length corresponding to their respective margin lines and, in addition, their combined length, shall not exceed twice the permissible length based on the lower margin line.

**§ 73.10–30 Compartment exceeding permissible length.**

(a) A compartment may exceed the permissible length determined by this subpart provided the combined length of each pair of adjacent compartments to which the compartment in question is common does not exceed either the floodable length or twice the permissible length, whichever is the less.

(b) If one of the two adjacent compartments is situated inside the machinery space, and the second is situated outside the machinery space, and the average permeability of the portion of the vessel in which the second is situated differs from that of the machinery space, the combined length of the two compartments shall be adjusted to the mean average permeability of the two portions of the vessel in which the compartments are situated.

**§ 73.10–35 Additional subdivision at forward end.**

(a) In vessels 330 feet in length and upward, one of the main transverse bulkheads abaft the forepeak shall be fitted at a distance from the forward perpendicular which is not greater than the permissible length.

**§ 73.10–40 Stepped bulkheads.**

(a) A main transverse bulkhead may be stepped provided that it meets one of the following conditions:

(1) The combined length of the two compartments, separated by the bulkhead in question, does not exceed either 90 percent of the floodable length or twice the permissible length, except that in ships having a factor of subdivision greater than .9, the combined length of the two compartments in question shall not exceed the permissible length.

(2) Additional subdivision is provided in way of the step to maintain the same measure of safety as that secured by a plane bulkhead.

(3) The compartment over which the step extends does not exceed the permissible length corresponding to a margin line taken 3 inches below the step.

**§ 73.10–45 Recessed bulkheads.**

(a) A main transverse bulkhead may be recessed provided that all parts of the recess lie inboard of vertical surfaces on both sides of the vessel, situated at a distance from the shell plating equal to one-fifth the breadth of the vessel, as defined in § 73.05–4, and at right angles to the centerline at the level of the deepest subdivision load line. Any part of a recess which lies outside these limits shall be dealt with as a step in accordance with § 73.10–40.

**§ 73.10–50 Equivalent plane bulkheads.**

(a) Where a main transverse bulkhead is recessed or stepped, an equivalent plane bulkhead shall be used in determining the subdivision.

**§ 73.10–55 Minimum spacing of bulkheads.**

(a) If the distance between two adjacent main transverse bulkheads, or their equivalent plane bulkheads, or the distance between the transverse planes passing through the nearest stepped portions of the bulkheads, is less than 10 feet plus 3 percent of the length of the vessel, or 35 feet whichever is less, only one of these bulkheads shall be regarded as forming a part of the subdivision of the vessel in accordance with the provisions of this subpart and for the application of damaged stability requirements contained in § 74.10–15 of this subchapter.

**§ 73.10–60 Allowances for local subdivision.**

(a) Where a main transverse watertight compartment contains local subdivision, and it can be shown to the satisfaction of the Commandant that, after any assumed side damage extending over a length equal to the minimum spacing of bulkheads set forth in § 73.10–55, the whole volume of the main compartment will not be flooded, a proportionate allowance may be made in the permissible length otherwise required for such compartment. In such a case the volume of effective buoyancy assumed on the undamaged side shall not be greater than that assumed on the damaged side.

**§ 73.10–65 Special standards of subdivision for certain vessels on short international voyages.**

(a) Special standards of subdivision apply to certain vessels on short international voyages, which are permitted under § 75.10–10 of this subchapter to carry a number of persons on board in excess of the lifeboat capacity provided. Such vessels shall be subject to the provisions of § 73.10–5 (a), (b), (d), and (e) and §§ 73.10–10 through 73.10–60, inclusive.

(b) Such vessels shall additionally comply with the following provisions:

(1) *Permeability.* (i) The uniform average permeability throughout the portion of the ship before (or abaft) the machinery space shall be determined from the formula:

$$95-35\frac{b}{v} \qquad (1)$$

where:

$b$ = volume of the spaces below the margin line and above the tops of floors, inner bottoms, or peak tanks, as the case may be, which are appropriated to and used as cargo spaces, coal or oil fuel bunkers, storerooms, baggage and mailrooms, chain lockers and fresh water tanks, before (or abaft) the machinery space.

$v$ = whole volume of the portion of the ship below the margin line before (or abaft) the machinery space.

(ii) In the case of ships engaged on services where the cargo holds are not generally occupied by any substantial quantities of cargo, no part of the cargo space is to be included in calculating "$b$".

(2) *Required factor of subdivision.* (i) Subject to the conditions stated in this subparagraph, the subdivision shall be governed by a factor of .50 unless the factor determined by § 73.10–20 is less than .50. In such case the lesser value shall be used.

(ii) In the case of ships less than 300 feet in length, the Commandant, if satisfied that compliance with a factor of .5 or less would be impracticable in a compartment, may allow the length of such compartment to be governed by a higher factor: *Provided,* That the factor used is the lowest that is practicable and reasonable in the circumstances.

(iii) In the case of ships less than 180 feet in length, the Commandant, where considered necessary for practicability, may permit a further relaxation in the standard of subdivision subject to the requirement that the subdivision shall in no case be less than that provided by § 73.15–5.

## Subpart 73.15—Rules for Subdivision—Vessels in Services Other Than Ocean or Coastwise and Vessels Under 150 Gross Tons in Ocean or Coastwise Service and Not on an International Voyage

**§ 73.15–1 Permeability.**

(a) In making subdivision calculations, volumes shall be calculated to the margin line, and the permeability of spaces shall be taken as follows:

(1) Machinery spaces at 85 percent.

(2) Tanks, chain lockers, and spaces normally filled with cargo, stores, mail, or baggage in the full load condition at 60 percent.

(3) All other spaces at 95 percent.

**§ 73.15–5 Compartmentation of all vessels other than ferry vessels.**

(a) Every mechanically propelled vessel whether or not specifically required by this section to meet at least a one-compartment standard of subdivision shall be fitted as follows:

(1) With not less than three transverse watertight bulkheads, or

(2) If in Great Lakes or limited coastwise service not more than 15 miles from the mouth of bays or harbors, with a collision bulkhead and with sufficient air tankage or other internal buoyancy to float the vessel when completely flooded, or

(3) If in lakes, bays and sounds or river service, with sufficient air tankage or other internal buoyancy to float the vessel when completely flooded.

(4) The use of internal buoyancy shall not permit omission of bulkheads required by other parts of the regulations in this chapter dealing with machinery installations, etc.

(b) Every mechanically propelled vessel of more than 75 gross tons, or carrying more than 49 passengers shall be subdivided so as not to submerge the margin line with any one main compartment flooded.

(c) Every vessel carrying more than 400 passengers shall, in addition to the requirements of paragraph (b) of this section, be subdivided so as not to submerge the margin line with the fore peak and the adjacent main compartment both flooded.

(d) Every vessel carrying more than 600 passengers shall, in addition to the requirements of paragraph (b) of this section, be subdivided so as not to submerge the margin line with any two adjacent main compartments flooded within at least the forward 40 percent of the vessel's length from the forward perpendicular.

(e) Every vessel carrying more than 800 passengers shall, in addition to the requirements of paragraph (b) of this section, be subdivided so as not to submerge the margin line with any two adjacent main compartments flooded within at least 60 percent of the vessel's length from the forward perpendicular.

(f) Every vessel carrying more than 1,000 passengers shall be subdivided by main transverse watertight bulkheads so as not to submerge the margin line with any two adjacent main compartments flooded.

**§ 73.15–10 Compartmentation of ferry vessels.**

(a) Every ferry vessel 150 feet or less in waterline length shall be subdivided by main transverse watertight bulkheads so as not to submerge the margin line with any one main compartment flooded. However, if sufficient air tankage or

other internal buoyancy is provided to float the vessel when completely flooded, the bulkheads may be dispensed with unless the vessel is in Great Lakes service, in which case the peak collision bulkhead must be retained.

(b) Every ferry vessel over 150 feet in waterline length shall, in addition to one-compartment subdivision, be subdivided so as not to submerge the margin line with either of the peak compartments and its adjacent main compartment both flooded.

(c) Every ferry vessel over 200 feet in waterline length shall be subdivided by main transverse watertight bulkheads so as not to submerge the margin line with any two adjacent main compartments flooded.

**§ 73.15–15 Minimum spacing of bulkheads.**

(a) To be considered effective, watertight bulkheads abaft the collision bulkhead shall be spaced not less than 10 feet plus 3 percent of the load waterline length. For ferry vessels, this minimum spacing shall be applicable between peak bulkheads.

**§ 73.15–20 Stepped bulkheads.**

(a) Watertight bulkheads shall not be stepped unless additional subdivision is provided in way of the step to maintain the same measure of safety as that secured by a plane bulkhead. Where a vessel can withstand flooding of the two adjacent compartments separated by a stepped bulkhead and no part of such bulkhead is nearer to either of the other bulkheads bounding the adjacent compartments than is permitted by § 73.15–15, the step will be acceptable.

**§ 73.15–25 Recessed bulkheads.**

(a) If watertight bulkheads are recessed, the recess shall be inboard from the vessel's side by at least one-fifth the beam amidship measured at right angles to the centerline at the level of the load waterline, otherwise, the bulkhead shall meet the requirements for a stepped bulkhead.

(b) For vessels in other than ocean or coastwise service, where the maximum molded beam at the deck and at the load waterline differ appreciably, the inboard damage penetration may be assumed at a mean position between that corresponding to one-fifth the maximum molded beam at the deck measured inboard at the deck and that corresponding to one-fifth the maximum molded beam at the load waterline measured inboard at the load waterline.

**§ 73.15–30 Equivalent plane bulkheads.**

(a) Where a main transverse bulkhead is recessed or stepped, an equivalent plane bulkhead shall be used in determining the subdivision.

## Subpart 73.20—Peak and Machinery Space Bulkheads, Shaft Tunnels

**§ 73.20–1 Collision bulkhead.**

(a) Every vessel except as noted herein shall have a fore peak or collision bulkhead, which shall be watertight up to the bulkhead deck. This bulkhead shall be fitted not less than 5 percent of the length of the vessel (5 feet minimum for steam vessels), and not more than 10 feet plus 5 percent of the length of the vessel from the forward perpendicular. For ferry vessels, this is applicable to both peak bulkheads. However, for ferry and other vessels in lakes, bays, and sounds or river service, where internal buoyancy is permitted in lieu of bulkheads, collision bulkheads are not required.

(b) If a vessel in ocean or coastwise service has a long forward superstructure, the fore peak bulkhead shall be extended weathertight to the deck next above the bulkhead deck. The extension need not be fitted directly over the bulkhead below, provided it is at least 5 percent of the length of the vessel from the forward perpendicular and the part of the bulkhead deck which forms the step is made effectively weathertight.

(c) Notwithstanding any other provisions regarding permissible location of openings in bulkheads, watertight doors, portable plates, and similar openings will not be permitted in the collision bulkhead. This will not apply to doors fitted in weathertight bulkheads above the bulkhead deck.

**§ 73.20–5 Machinery space bulkheads.**

(a) In vessels other than vessels where internal buoyancy is provided to replace subdivision bulkheads, the machinery space as defined in § 73.05–10 shall be divided from the cargo and passenger spaces forward and aft by bulkheads that are fitted watertight up to the bulkhead deck.

**§ 73.20–10 After peak bulkhead.**

(a) On vessels over 150 gross tons, and all vessels on an international voyage regardless of tonnage, an after peak bulkhead shall be fitted and made watertight up to the bulkhead deck. However, this bulkhead may be stopped below the bulkhead deck provided the degree of safety of the vessel as regards subdivision is not thereby diminished.

**§ 73.20–15 Shaft tunnels.**

(a) On all vessels over 150 gross tons in ocean, coastwise, or Great Lakes service, and all vessels on an international voyage regardless of tonnage, stern tubes shall be enclosed in watertight spaces of moderate volume. The stern gland shall be situated in a watertight shaft tunnel or other watertight space separate from the stern tube compartment and of such volume that, if flooded by leakage through the stern gland, the margin line will not be submerged.

## Subpart 73.25—Double Bottoms

**§ 73.25–1 Application.**

(a) The provisions of this subpart shall be applicable to all vessels on international voyages and in ocean, coastwise, or Great Lakes service.

**§ 73.25–5 Extent of double bottoms.**

(a) A double bottom should be fitted extending from the fore peak bulkhead to the after peak bulkhead as far as is practicable and compatible with the design and proper working of the vessel.

(b) In vessels 165 feet and under 200 feet in length a double bottom shall be fitted at least from the machinery space to the forepeak bulkhead, or as near thereto as practicable.

(c) In vessels 200 feet and under 249 feet in length a double bottom shall be fitted at least outside the machinery space, and shall extend to the fore and afterpeak bulkheads, or as near thereto as practicable.

(d) In vessels 249 feet in length and upwards a double bottom shall be fitted amidships and shall extend to the fore and afterpeak bulkheads or as near thereto as practicable.

(e) Where a double bottom is required to be fitted its depth shall be sufficient to provide acceptable protection against grounding. A depth in inches at the centerline of $18+\frac{L}{20}$, where $L$ is the vessel's length in feet will ordinarily be considered acceptable. The inner bottom shall be continued out to the ship's side in such a manner as to protect the bottom to the turn of the bilge. Such protection will be deemed satisfactory if the line of intersection of the outer edge of the margin plate with the bilge plating is not lower at any part than a horizontal plane passing through the point of intersection with the frame line amidships of a transverse diagonal line inclined at 25 degrees to the base line and cutting it at a point one-half the ship's molded breadth from the middle line.

(f) A double bottom need not be fitted in way of watertight compartments of moderate size used exclusively for the carriage of liquids, provided the safety of the ship, in the event of bottom or side damage, is not, in the opinion of the Commandant, thereby impaired.

(g) In the case of vessels to which the provisions of § 73.10–65 apply and which are engaged in regular service within the limits of a short international voyage as defined in § 70.10–43 of this subchapter, the Commandant may permit a double bottom to be dispensed with in any part of the vessel which is subdivided by a factor not exceeding .50, if satisfied that the fitting of a double bottom in that part would not be compatible with the design and proper working of the vessel.

**§ 73.25–10 Wells in double bottoms.**

(a) Small wells constructed in the double bottom in connection with drainage arrangements of holds, etc., shall not extend downward more than necessary. The depth of the well shall in no case be more than the depth less 18 inches of the double bottom at the center line, nor shall the well extend below the horizontal plane referred to in § 73.25–5 (e). A well extending to the outer bottom is, however, permitted at the after end of the shaft tunnel of screw vessels. Other wells, such as for lubricating oil under main engines, may be permitted by the Commandant, if satisfied that the arrangements give protection equivalent

to that afforded by a double bottom complying with this section.

**§ 73.25–15 Manholes in double bottoms.**

(a) The number of manholes in the inner bottom shall be reduced to the minimum compatible with the design and necessity for access to the double bottom. Efficient covers, capable of being made thoroughly watertight and effectively protected from damage by cargo, or coal, shall be fitted to the manholes.

**§ 73.25–20 Watertight floors in double bottoms.**

(a) Watertight transverse divisions should be fitted in the double bottom under each main watertight subdivision bulkhead or as near thereto as practicable. Where duct keels are fitted, the transverse divisions need not extend across the duct keel.

## Subpart 73.30—Penetrations and Openings in Watertight Bulkheads

**§ 73.30–1 General.**

(a) The number of openings in watertight bulkheads shall be reduced to the minimum compatible with the design and proper working of the vessel; satisfactory means shall be provided for closing these openings. Lead or other heat sensitive materials shall not be used in systems which penetrate watertight subdivision bulkheads, where deterioration of such systems in the event of fire would impair the watertight integrity of the bulkheads.

**§ 73.30–5 Pipes, cables, etc.**

(a) Where pipes, scuppers, electric-light cables, etc., are carried through watertight subdivision bulkheads, arrangements shall be made to insure the integrity of the watertightness of the bulkheads.

**§ 73.30–10 Valves and cocks.**

(a) Valves and cocks not forming part of a piping system shall not be permitted in watertight subdivision bulkheads.

**§ 73.30–15 Prohibited locations for access openings.**

(a) No doors, manholes, or access openings are permitted in the following locations:

(1) Collision bulkhead below the margin line.

(2) Watertight transverse bulkheads dividing a cargo space from an adjoining cargo space or from a permanent or reserve bunker.

**§ 73.30–20 Pipes through collision bulkhead.**

(a) For details of piping through collision bulkheads, see Subchapter F (Marine Engineering) of this chapter.

**§ 73.30–25 Watertight door limitations.**

(a) *General.* (1) Watertight door openings shall be located as high in the bulkhead and as far inboard as practicable. The number of watertight doors shall be reduced to the minimum consistent with the design and proper working of the vessel.

(b) *Machinery space doors.* (1) Within spaces containing the main and auxiliary propelling machinery including boilers serving the needs of propulsion and all permanent bunkers, not more than one door apart from the doors to bunkers and shaft tunnels may be fitted in each main transverse bulkhead. Where two or more shafts are fitted, the tunnels shall be connected by an intercommunicating passage. There shall be only one door between the machinery space and the tunnel spaces where not more than two shafts are fitted and only two doors where there are more than two shafts. Except as provided in § 73.35–5(b), all these doors shall be of the sliding type and shall be located so as to have their sills as high as practicable. The hand gear for operating these doors from above the bulkhead deck shall be situated outside the spaces containing the machinery if this is consistent with a satisfactory arrangement of the necessary gearing.

(c) *Bunker doors.* (1) Watertight doors fitted in bulkheads between permanent and reserve bunkers shall be always accessible except as provided in § 73.35–15 (b) for between deck bunker doors. Satisfactory arrangements shall be made by means of screens or otherwise, to prevent the coal from interfering with the closing of watertight bunker doors.

**§ 73.30–30 Trunkways or tunnels.**

(a) Where trunkways or tunnels for access from crew's accommodations to the stokehold, for piping, or for any other purpose are carried through main transverse watertight bulkheads, they shall be watertight and in accordance with structural requirements for watertight bulkheads. The access to at least one end of each such tunnel or trunkway, if used as a passage at sea, shall be through a trunk extending watertight to a height sufficient to permit access above the margin line. The access to the other end of the trunkway or tunnel may be through a watertight door of the type required by its location in the ship. Such trunkways or tunnels shall not extend through the first subdivision bulkhead abaft the collision bulkhead.

(b) A short tunnel extending through not more than one main subdivision compartment and which is closed at one end need not be fitted with a door at the other end, provided its sides are not nearer to the shell than is permitted for the sides of a recess in a bulkhead as stated in § 73.15–25 and the volume of the tunnel, if included with the volume of the compartment to which it opens, does not result in the equivalent length of such compartment being in excess of the permissible length.

(c) Where it is proposed to fit tunnels or trunkways for forced draft, piercing main transverse watertight bulkheads, these shall receive the special consideration of the Commandant.

**§ 73.30–35 Portable plates.**

(a) Openings closed only by portable bolted plates are not permitted in watertight subdivision bulkheads except in machinery spaces. Such plates shall always be in place and made watertight before the vessel leaves port and shall not be removed at sea except in case of urgent necessity.

**§ 73.30–40 Openings above margin line.**

(a) Where a portion of an assumed margin line is appreciably below the deck to which bulkheads are carried, and it can be shown that the maintenance of complete watertightness will result in undue hardship in the arrangement of the vessel, a limited amount of nontight bulkhead penetrations may be permitted as high as possible immediately under the bulkhead deck. Such penetrations shall be subject to specific approval in each instance and will generally be limited as follows:

(1) Not more than 2 feet below the molded line of the bulkhead deck.

(2) Not less than 9 inches above the margin line.

(3) Not outboard of vertical lines located off the centerline at a distance of ¼ the full breadth of the ship measured on the bulkhead deck at the point in question.

(b) Approved nontight bulkhead penetrations shall be indicated on a suitable plan carried aboard the vessel.

## Subpart 73.35—Watertight Bulkhead Doors

**§ 73.35–1 Types and classes.**

(a) The only types of watertight doors permissible are hinged doors, sliding doors, and doors of other equivalent patterns, excluding plate doors secured only by bolts and doors required to be closed by dropping or by the action of a dropping weight. Sliding doors may have horizontal or vertical motion. The permissible classes of doors are:

Class 1—Hinged doors.
Class 2—Sliding doors, operated by hand gear only.
Class 3—Sliding doors, operated by power and by hand gear.

(b) Where a door of a particular class is specified, a door of a class bearing a lower number may not be fitted, but a door of a class bearing a higher number may be fitted unless otherwise noted.

**§ 73.35–5 Class 1 doors, permissible locations.**

(a) Class 1 doors within passenger, crew, and working spaces are only permitted above a deck, the molded line of which, at its lowest point at side, is at least 7 feet above the deepest subdivision load line, and they are not permitted in such spaces below such a deck except as permitted in paragraph (b) of this section.

(b) On vessels under 150 gross tons in coastwise or Great Lakes service not proceeding more than 20 miles from shore and on all vessels on other inland waters, Class 1 doors may be permitted within any accommodation and working spaces provided it is practical to keep such doors closed at all times except when actually being used for transit.

**§ 73.35–10 Class 2 doors, permissible locations.**

(a) Watertight doors, the sills of which are above the deepest loadline and below the line specified in § 73.35–5(a) shall be sliding doors and may be hand operated (Class 2), except as provided in § 73.35–15(d).

(b) When the number of watertight doors which may be sometimes opened at sea, and whose sills are below the deepest subdivision loadline (excluding doors at entrance to shaft tunnels) does not exceed five and the ship has no passenger spaces below the bulkhead deck, these watertight doors and the shaft tunnel doors shall be of sliding type but may be hand operated (Class 2).

(c) When the total number of watertight doors which may be sometimes opened at sea, and whose sills are below the deepest subdivision loadline, does not exceed two and they are into or within the space containing machinery, these two doors shall be of sliding type but may be hand operated (Class 2).

**§ 73.35–15 Class 3 doors, required locations.**

(a) When the number of watertight doors which may be sometimes opened at sea, and whose sills are below the deepest subdivision loadline (excluding doors at entrance to shaft tunnels) exceeds five, or where the vessel has passenger spaces below the bulkhead deck, all of these doors and those at the entrance to shaft tunnels or ventilation or forced draft ducts shall be power operated (Class 3), and shall be capable of being simultaneously closed from a central station situated on the bridge.

(b) If watertight doors are fitted between bunkers in the 'tween decks below the bulkhead deck and have to be opened at sea for the purpose of trimming coal, these doors shall be of Class 3.

(c) When trunkways, in connection with refrigerated cargo, are carried through more than one main transverse watertight bulkhead and the sills of the trunkway doors are less than 7 feet above the deepest subdivision load line, these doors shall be of Class 3.

(d) In the case of vessels engaged on short international voyages, subject to the provisions of § 73.10–65, and required to have a factor of subdivision of .50 or less, all watertight doors below a deck, the molded line of which, at its lowest point at side, is at least 7 feet above the deepest subdivision loadline shall be power-operated (Class 3).

**§ 73.35–17 Cargo space doors.**

(a) Where it is proposed to fit doors between cargo tween deck spaces the number and arrangement will be subject to special consideration. Where the Commandant is satisfied that such doors are essential, watertight doors of satisfactory construction may be fitted in bulkheads dividing cargo between-deck spaces. Such doors may be hinged, rolling or sliding doors but shall not be remotely controlled. They shall be fitted at the highest level and as far from the shell plating as practicable but in no case shall the outboard vertical edges be situated at a distance from the shell plating which is less than one-fifth of the breadth of the ship, as defined in § 73.05–4, such distance being measured at right angles to the centerline of the vessel at the level of the deepest subdivision loadline.

(b) Such doors shall be closed before the voyage commences and shall be kept closed during navigation; and the time of opening such doors in port and of closing them before the vessel leaves port shall be entered in the log book. Should any of the doors be accessible during the voyage, they shall be fitted with a device which prevents unauthorized opening.

**§ 73.35–20 Door operating requirements.**

(a) Hinged watertight doors (Class 1) shall be fitted with quick action closing devices, such as catches workable from either side of the bulkhead so spaced that the door can be made effectively watertight. In the case of a door which is required to be closed before the voyage commences and kept closed all during the voyage, the catches may be fitted to operate from one side only, provided it be shown that under all operating conditions the door shall be always closed from the one side.

(b) Both Class 2 and Class 3 sliding watertight doors shall be provided with hand operating gear, capable of being operated from positions on each side of the door itself and also of closing (but not opening) the door from an accessible position above the bulkhead deck. Hand operating gear shall have an all around crank motion, or some other movement, approved by the Commandant as providing equivalent safety. The time for closing a Class 2 door, with the vessel upright, shall not exceed 90 seconds.

(c) Class 3 sliding watertight doors:

(1) Class 3 sliding watertight doors which are required to be operated from a central control on the bridge shall also be operated by power at the door itself from both sides. The arrangement shall be such that the door will close automatically if opened by local control after being closed from the central control, and also such that any door can be kept closed by local arrangements which will prevent that door from being opened from the central control. Local power control handles shall be provided on each side of the bulkhead and shall be so arranged as to enable persons passing through the doorway to hold both handles in the open position without being able to set the closing mechanism in operation accidentally. The door shall take sufficient time to close to ensure safety.

(2) There shall be at least two independent power sources capable of opening and closing all the doors under control, each of them capable of operating all the doors simultaneously. Operations will be regarded as simultaneous if all doors can be closed in not more than 60 seconds after actuation of a single master control. The power source shall have indicating lights at the central control station to indicate which power source is available for use. The power supply sources for the operation of electric power-operated watertight doors shall meet the requirements of § 111.65–30(c) in Subchapter J (Electrical Engineering) of this chapter. In the case of hydraulic operation, each power source shall consist of a pump capable of closing all doors within the foregoing time limit. In addition, there shall be, for the whole installation, hydraulic accumulators of sufficient capacity to operate all the doors at least three times, i.e., closed-open-closed. In the case of combination electric hydraulic systems utilizing individual electrically-driven hydraulic actuators on each door, a duplication of these actuators and drives is not required. The fluid used in hydraulic systems shall be one which retains adequate operational fluidity at any temperature liable to be encountered by the vessel during its service.

(3) The requirement for operation of Class 3 doors from the central control station on the bridge refers to closing of the doors. Remote opening is not required but, if provided, shall comply with the applicable provision of subparagraph (1) of this paragraph.

(d) The means of operation of any watertight door whether power-operated or not shall be capable of closing the door with the ship listed to 15 degrees either way.

**§ 73.35–25 Door indicators and warning signals.**

(a) In all classes of watertight doors, indicators shall be fitted, which show, at all operating stations from which the doors are not visible, whether the doors are opened or closed. If any of the watertight doors, of whatever class, is not fitted so as to enable it to be closed from a central control station, it shall be provided with a mechanical, electrical, telephonic, or any other suitable direct means of communication, enabling the officer of the watch promptly to contact the person who is responsible for closing the door in question, under previous orders. Watertight doors and controls shall be marked as provided by § 78.47–37 of this subchapter.

(b) For Class 3 watertight doors, provision shall be made to give warning signal by electric horn or howler when the door is about to be closed; the signal shall precede the movement of the door by a safe interval and shall continue until the door is completely closed.

**§ 73.35–30 Doors, design, installation, and tests.**

(a) The design of all watertight doors shall be subject to approval by the Commandant.

(b) Each Class 1 door installed on a vessel in ocean or coastwise service shall be tested by water pressure to a head up to the margin line, but in no case less than 10 feet. Such doors on vessels in other services shall be tested in the same manner as the bulkhead in which they are fitted.

(c) Each Class 2 and Class 3 door shall be designed, tested, and installed in accordance with Subpart 163.001 of Sub-

chapter Q (Specifications) of this chapter.

## Subpart 73.40—Openings in Vessel's Sides Below the Bulkhead Deck

### § 73.40–1 General.

(a) The requirements of this section apply to all openings in the sides of vessels below the bulkhead deck whether or not such openings give direct access to spaces above or below the bulkhead deck, except as otherwise specified in this subchapter.

(b) In the case of a vessel not having a continuous bulkhead deck it is necessary that special consideration should be given to the application of this section, particularly with regard to openings through the sides of the vessel in way of or leading from spaces below the highest of the trim lines used in the development of the floodable length curves.

(c) The number of openings in vessel's sides below the bulkhead deck shall be reduced to the minimum compatible with the proper design and working of the vessel.

(d) The arrangement and efficiency of the means for closing each opening shall be consistent with its intended purpose and the position in which it is fitted, and shall be to the satisfaction of the Commandant.

### § 73.40–5 Port lights.

(a) Port lights on vessels under 150 gross tons in ocean or coastwise service, and on all vessels in Great Lakes, lakes, bays, and sounds, or river service as follows:

(1) No port lights are permitted in the vessel's side below the bulkhead deck.

(b) Port lights on vessels of 150 gross tons and over in ocean or coastwise service as follows:

(1) If, in a 'tween deck, the sills of any port lights are below a line drawn parallel to the molded line of the bulkhead deck at side and having its lowest point 2½ percent of the breadth of the vessel above the deepest subdivision load line, all port lights in that 'tween deck shall be of a nonopening type.

(2) All port lights, the sills of which are below the bulkhead deck, other than those required to be of a nonopening type shall be of such construction as will effectively prevent any person opening them without the consent of the master of the vessel.

(3) No port lights shall be fitted in spaces which are appropriated exclusively to the carriage of cargo, stores, or coal.

(4) Port lights may be fitted in spaces appropriated alternately to the carriage of cargo or passengers and they shall be of the type required by their location in the vessel, provided dead covers are always fitted when cargo is carried.

(5) Design of port lights below the bulkhead deck as follows:

(i) All port lights are to be of substantial construction subject to approval of the Commandant.

(ii) Nonopening port lights are to be thoroughly watertight and port lights which are capable of being opened shall be so constructed that they can be easily and effectively closed and secured watertight. Port lights capable of being opened shall have fitted to one or more of the bolts a special round slotted or recessed nut requiring a special wrench. The special nuts are to be protected by sleeves or guards so as to render them incapable of being released by the use of ordinary tools, such as pipe wrenches, etc.

(c) *Dead covers.* (1) Hinged inside dead covers shall be fitted to all port lights below the margin line except that dead covers may be portable in passenger accommodations other than for steerage passengers provided they are stowed adjacent to their respective port lights and that all the following conditions are complied with.

(i) Such port lights are above the deck to which the minimum freeboard for the vessel can be obtained.

(ii) Such port lights are abaft one-eighth of the vessel's length from the forward perpendicular.

(iii) Such port lights are above a line drawn parallel to the bulkhead deck at side and having its lowest points at a height of 12 feet plus 2½ percent of the breadth of the vessel above the deepest subdivision load line.

(2) Dead covers shall be of efficient design and arranged so that they can be easily and effectively secured watertight. Where fitted to opening-type port lights, they shall be of such design that it will not be necessary to release the special or locked nut in order to secure the dead cover.

### § 73.40–10 Automatic ventilators.

(a) Automatic ventilators shall not be fitted in vessel's sides below the bulkhead deck without the special sanction of the Commandant.

### § 73.40–15 Side ports.

(a) Gangway, cargo, and coaling ports, and similar openings in the vessel's sides shall be designed and constructed to the approval of the Commandant. Such ports or openings shall be in no case fitted so as to have their lowest point below the deepest subdivision load line.

### § 73.40–20 Piping openings in vessel's sides.

(a) Requirements for inlets and discharges of scuppers, sanitary piping, main and auxiliary machinery piping, and ash and rubbish-chutes, etc., are in § 55.10–70 of Subchapter F (Marine Engineering) of this chapter.

## Subpart 73.45—Watertight Integrity Above the Margin Line

### § 73.45–1 General.

(a) All reasonable and practicable measures shall be taken to limit the entry and spread of water above the bulkhead deck. Such measures may include partial bulkheads or webs.

(b) When partial watertight bulkheads and webs are fitted on the bulkhead deck, above or in the immediate vicinity of main subdivision bulkheads, they shall have watertight shell and bulkhead deck connections so as to restrict the flow of water along the deck when the vessel is in a heeled-damaged condition. Where the partial watertight bulkhead does not line up with the bulkhead below, the bulkhead deck between shall be made effectively watertight.

### § 73.45–5 Decks.

(a) The bulkhead deck or a deck above it shall be weathertight in the sense that in ordinary sea conditions water will not penetrate in a downward direction.

(b) All openings in the exposed weather deck shall have coamings of ample height and strength and shall be provided with efficient means for expeditiously closing them weathertight.

(c) Freeing ports, open rails and/or scuppers shall be fitted as necessary for rapidly clearing the weather deck of water under all weather conditions.

### § 73.45–10 Side openings.

(a) All side openings in the vessel's shell above the bulkhead deck and all deck openings in or above the bulkhead deck shall comply with the applicable requirements of Subchapters E (Load Lines) and F (Marine Engineering) of this chapter for type closures and fittings. Port lights, gangway, cargo and coaling ports and other means for closing openings in the shell plating above the margin line shall be of efficient design and construction and of sufficient strength having regard to the spaces in which they are fitted and their positions relative to the deepest subdivision loadline.

(b) Efficient inside dead covers, arranged so that they can be easily and effectively closed and secured watertight, shall be provided for all port lights to spaces below the first deck above the bulkhead deck.

## Subpart 73.90—Vessels Contracted for Prior to May 26, 1965

### § 73.90–1 Requirements.

(a) Vessels contracted for prior to May 26, 1965, shall meet the following requirements:

(1) Existing arangements, materials, and facilities previously approved will be considered satisfactory so long as they meet the minimum requirements of this section, and they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standards as the original installation.

(2) The details and arrangements shall be in general agreement with the applicable provisions of Subparts 73.05 through 73.45 insofar as is reasonable and practicable.

# PART 74—STABILITY


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Subpart 74.90—Vessels Contracted for Prior to May 26, 1965

74.90–1 Requirements.


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## Subpart 74.01—Application

### § 74.01–1 General.

(a) The provisions of this part shall apply to the following vessels:

(1) All vessels on an international voyage.

(2) All vessels carrying more than 49 passengers or of more than 100 gross tons.

(3) All ferry vessels.

(4) Any other vessel whose stability is questioned by the Officer in Charge, Marine Inspection, including any vessel subject to the act of May 10, 1956 (46 U. S. C. 390–390g).

(b) The provisions of this part, with the exception of Subpart 74.90, shall apply to all the vessels noted in paragraph (a) of this section, which are contracted for on or after May 26, 1965. Such vessels contracted for prior to May 26, 1965, shall meet the requirements of Subpart 74.90.

## Subpart 74.05—Stability Test

### § 74.05–1 When required.

(a) Except as otherwise provided in this section, each vessel to which this part applies, shall be subjected to a stability test conducted under the supervision of the Coast Guard and the results of the test shall be approved before the vessel is placed in service. Whenever alterations to a vessel are sufficiently extensive to make use of the data obtained from the original stability test questionable in the circumstances, it shall be re-inclined.

(b) The Commandant may allow the stability test of a vessel to be dispensed with provided basic stability data are available from the stability test of a sister vessel and it is shown to the satisfaction of the Commandant that reliable stability information for the exempted vessel can be obtained from such basic data.

(c) Except for vessels on an international voyage, the Commandant may allow the stability test of a vessel to be dispensed with in exceptional cases where it can be shown to his satisfaction that due to the form, construction, and arrangement of the vessel stability calculations can be safely made without a stability test being performed.

### § 74.05–5 Procedure.

(a) Stability tests shall meet the requirements of this section.

(b) Plans required: (1) The following plans are essential for use in conducting the stability test and determining the results, and if these plans have not been previously submitted, they shall be made available at the time of the test:

Lines plan.
Curves of form or hydrostatic curves.
General arrangement plans of decks, holds, inner bottoms, etc.
Outboard profile.
Inboard profile.
Midship section.
Capacity plan showing capacities and vertical and longitudinal centers of gravity of cargo spaces, tanks, etc.
Tank sounding tables.
Draft mark locations.

(c) Stability test preparations: (1) Preparations as noted in this paragraph shall be made to place a vessel in suitable condition for a stability test. The Coast Guard representative supervising the stability test may relax from these standards in a particular instance if, in his opinion, such relaxation is warranted and will not materially affect the reliability of the results of the test.

(2) To obtain dependable stability results, all tanks on the vessel, as far as practicable, shall be either completely empty and dry or fully pressed up and without air pockets. Where this is impracticable, slack tanks may be accepted provided their free surface can be readily and accurately determined for the angles of heel to be obtained during the stability test.

(3) The vessel shall be as nearly complete as practicable when the test is conducted. If additional material or equipment is to be installed after the test, a complete list of such items by weight and location shall be prepared.

(4) All dunnage, tools, and other items extraneous to the completed vessel shall be removed before the test.

(5) The vessel shall be moored in a location reasonably protected from broadside wind, waves and tide. The depth of water shall be sufficient to provide ample clearance under the vessel against grounding. Mooring lines shall be arranged so that they will not interfere with the free rolling or listing of the vessel.

## Subpart 74.10—Stability Standards

### § 74.10–1 General.

(a) With the vessel in the intact condition, the net metacentric height at any operating draft, including allowance for normally slack tanks, shall not be less than the standards outlined in this subpart, taken singly, and the most severe requirement shall govern at any particular draft.

### § 74.10–5 Weather criteria.

(a) The required minimum metacentric height (GM) in feet at any particular draft is obtained from the following formula:

$$GM=\frac{PAh}{\Delta \tan \theta} \qquad (1)$$

where:

$P=.005+\left(\frac{L}{14{,}200}\right)^2$ tons/ft² for ocean and coastwise service.

$P=.0033+\left(\frac{L}{14{,}200}\right)^2$ tons/ft² for partially protected waters such as lakes, bays, and sounds, and Great Lakes (summer service).

$P=.0025+\left(\frac{L}{14{,}200}\right)^2$ tons/ft² for protected waters such as rivers, harbors, etc.

$L$ = Length between perpendiculars in feet.

$A$ = Projected lateral area in square feet of portion of vessel above waterline.

$h$ = Vertical distance in feet from center of $A$ to center of underwater lateral area or approximately one-half draft point.

$\Delta$ = Displacement in long tons.

$\theta$ = Angle of heel to one-half the freeboard to the deck edge or 14 degrees whichever is less. (For vessels having a discontinuous weather deck or abnormal sheer, the angle to one-half the freeboard may be suitably modified.)

### § 74.10–10 Passenger criteria.

(a) The required minimum metacentric height ($GM$) in feet is obtained from the following formula:

$$GM=\frac{N\times b}{24\Delta \tan \theta} \qquad (1)$$

where:

$N$ = Number of passengers.

$b$ = Distance in feet from the vessel's centerline to the geometrical center of the passenger deck area on one side of centerline.

$\Delta$ = Displacement in long tons.

$\theta$ = Angle of heel to deck edge or 14 degrees, whichever is less.

**§ 74.10–11 Special cases.**

(a) The criteria of §§ 74.10–5 and 74.10–10 are generally limited in application to flush deck powered vessels of ordinary proportions and form. In the case of vessels not considered to come within this category, the Commandant may require or accept a modification of these criteria or such additional calculations as may be necessary to demonstrate the limits of safe operation.

**§ 74.10–15 Damaged stability standards.**

(a) *Application.* (1) The provisions of this section shall apply to all vessels that are required by Subparts 73.10 and 73.15 of this subchapter to have at least a one-compartment standard of subdivision.

(b) *General requirements.* (1) Sufficient intact stability shall be provided in all service conditions so as to enable the vessel to withstand flooding at any place throughout its length due to the assumed side damage as outlined in paragraph (c)(4) of this section.

(2) Where two adjacent main subdivision compartments are separated by a bulkhead which is stepped under the conditions of § 73.10–40 or 73.15–20, the intact stability shall be adequate to withstand the flooding assumed under § 73.10–40 or 73.15–20 of this subchapter, as applicable.

(c) *Damaged stability calculations.* (1) The requirements of paragraph (b) of this section shall be determined by calculations which take into consideration the proportions and design characteristics of the vessel and the arrangement and configuration of the damaged compartments. Where decks, inner skins, or longitudinal bulkheads are to be fitted of sufficient tightness to seriously restrict the flow of water, the Commandant shall be satisfied that proper consideration is given to such restrictions in the calculations. Where it is considered that the range of stability in the damaged condition is doubtful, the Commandant will require the investigation thereof.

(2) In making these calculations the vessel is to be assumed in the worst anticipated service condition as regards stability.

(3) For damaged stability calculations the volume and surface permeabilities shall be in general as indicated in Table 74.10–15(c)(3). Higher surface permeabilities are to be assumed in respect of spaces which, in the vicinity of the damage waterplane, contain no substantial quantity of accommodation or machinery and spaces which are not generally occupied by any substantial quantity of cargo or stores. The maximum surface permeability which must be assumed need not exceed 95.

TABLE 74.10–15(c)(3)

| Spaces | Permeability |
|---|---|
| Appropriated to cargo, coal or stores | 60 |
| Appropriated to accommodations | 95 |
| Appropriated to machinery | 85 |
| Intended for liquids (use value resulting in more severe requirement) | 0 or 95 |

(4) The minimum assumed extent of side damage shall be taken in accordance with Table 74.10–15(c)(4). Where any damage of a lesser extent than provided in the table would result in a more severe condition regarding heel or loss of metacentric height, such damage shall also be considered in the calculations.

TABLE 74.10–15(c)(4)

| Vessel category | Longitudinal extent [1] | Transverse extent [2 3] | Vertical extent |
|---|---|---|---|
| All vessels | 10 feet+0.03L or 35 feet (whichever is less) no main bulkhead involved. | ⅛B | From base line upward without limit. |
| Vessels required by Subpart 73.15 to have a two compartment standard of subdivision. | 35 feet or 10 feet+0.03L (whichever is less) involving not more than one main bulkhead. | ⅛B | From base line upward without limit. |
| Vessels required by Subpart 73.10 to have a factor of subdivision of 0.50 or less. | 10 feet+0.03L or 35 feet (whichever is less) involving not more than one main bulkhead. | ⅛B | From base line upward without limit. |
| | 20 feet+0.04L, involving not more than one main bulkhead. | ⅛B | Top of double bottom upward without limit. |
| Vessels required by Subpart 73.10 to have a factor of subdivision of 0.33 or less. | 20 feet+0.04L, but in any case long enough to involve two main bulkheads | ⅛B | From base line upward without limit. |

[1] L equals the length of the vessel as defined in § 73.05–3.
[2] B equals the breadth of the vessel as defined in § 73.05–4.
[3] The transverse extent of damage is measured inboard from the vessel's side and at right angles to the centerline at the level of the deepest subdivision load line. For vessels on inland waters and for ferry vessels, where the maximum molded beam at the deck and at the load water line differ appreciably, the transverse extent of damage may be taken as the mean between the inboard penetration at the deck using the maximum beam at the deck and the inboard penetration at the deepest subdivision load line using the maximum beam at that load line.

(5) Unsymmetrical flooding is to be kept to a minimum consistent with efficient arrangements. Where it is necessary to correct large angles of heel, the means adopted shall, where practicable, be self-acting, but in any case where controls to cross-flooding fittings are provided they shall be operable from above the bulkhead deck. The construction and arrangement of such fittings and of their controls, together with the estimated maximum heel before equalization, is subject to approval by the Commandant. The time for equalization to acceptable heel limits, as provided in subparagraphs (7) and (8) of this paragraph, shall in no case be more than 15 minutes. On vessels under 150 gross tons in ocean or coastwise service and on all vessels in lake, bay, and sound or river service, the equalizing arrangements, where required, shall not be dependent either upon manual or automatic operation of valves or similar appliances.

(6) For symmetrical flooding, or in the case of unsymmetrical flooding, after equalization measures have been taken, there shall be a positive residual metacentric height of at least 2 inches (calculated on the basis of the initial undamaged displacement).

(7) For unsymmetrical flooding with assumed side damage not more than 10 feet plus .03L, the remaining heel due to unsymmetrical moment, after equalization, as provided by subparagraph (5) of this paragraph, shall not exceed 7 degrees. However, where equalization is fully automatic and by open cross connections of large area, or where no equalization is involved, and in any case, the range of stability in the damaged condition is considered adequate, the Commandant may allow a greater heel up to but not in excess of 15 degrees.

(8) For unsymmetrical flooding with assumed side damage in excess of 10 feet plus 0.03*L*, the remaining heel due to unsymmetrical moment, after equalization as provided by subparagraph (5) of this paragraph shall not exceed 15 degrees.

(9) In no case shall the margin line be submerged in the final stage of flooding. If it is considered that the margin line may become submerged during an intermediate stage of flooding, the Commandant may require such investigations and arrangements as shall be considered necessary for the safety of the vessel.

(d) *Relaxation of requirements.* (1) No relaxation from the requirements for damaged stability may be considered by the Commandant unless it is shown that the intact metacentric height in any service condition necessary to meet these requirements is excessive for the service intended.

(2) Relaxations from the requirements for damaged stability shall be permitted only in exceptional cases and subject to the conditions that the Commandant is to be satisfied that the proportions, arrangements and other characteristics of the vessel are the most favorable to stability after damage which can practically and reasonably be adopted in the particular circumstances.

**§ 74.10–20 Special operating conditions.**

(a) Where a vessel may be operated under conditions where its stability will be affected by factors not covered by §§ 74.10–5 through 74.10–15 such factors shall be investigated to determine if the vessel has sufficient stability to meet such conditions.

## Subpart 74.15—Ballast

**§ 74.15–1 When required.**

(a) Where it is determined that a vessel does not have sufficient stability to meet the requirements of the stability standard and the characteristics of the vessel cannot be altered to provide the required stability, ballast may be required. This ballast may be solid fixed ballast, liquid ballast, or both.

§ 74.15–5 How installed.

(a) Solid ballast, when required, shall be installed in the vessel under the supervision of the Officer in Charge, Marine Inspection. The amount of installed ballast shall be weighed or otherwise accurately determined and located in a vertical and longitudinal position to meet the stability requirements. This ballast shall be stowed in a satisfactory manner to prevent shifting of position in a seaway. Such ballast required for stability shall not be removed from the vessel or relocated unless approved by the Commandant, except that such ballast may be temporarily moved for examination or repair of the vessel, when done under the supervision of an inspector.

§ 74.15–10 Liquid ballast.

(a) When ballasting with water is necessary the water ballast should not, in general, be carried in tanks intended for oil fuel.

(b) In ships in which it is not practicable to avoid putting water ballast in oil fuel tanks, it will be required that all such ballast necessary to compliance with the stability requirements of this part be carried into port. Discharge of such ballast may then be effected either into sludge barges or shore facilities, or through oily ballast separators. In this latter case the separators shall meet the requirements prescribed in Subchapter F (Marine Engineering) of this chapter.

## Subpart 74.20—Stability Instructions for Operating Personnel

§ 74.20–1 Data supplied master.

(a) The master shall be supplied with such reliable information as is necessary to enable him by rapid and simple processes to obtain accurate guidance as to the stability of the ship under varying conditions of service, so as to permit compliance with stability requirements.

(b) This information and necessary related plans and data shall be submitted to the Commandant for approval.

§ 74.20–5 Conditions under which calculations made.

(a) The master of the vessel shall be informed of the conditions under which the damaged stability calculations have been made and advised to what extent the vessels can safely withstand damage under these assumed conditions.

§ 74.20–10 Cross-flooding.

(a) In the case of a vessel requiring cross-flooding, the master shall be provided with the conditions of stability on which the calculations of heel are based and be warned that excessive heel might result should the vessel sustain damage when in a less favorable condition. Suitable information shall be supplied concerning the use of any special cross-flooding fittings.

§ 74.20–15 Type of instructions.

(a) In all ships on international voyages the information called for by this subpart shall be provided in booklet form; at least two copies, one for the master and one for the chief engineer, being supplied each ship. Included as part of these booklets, at suitably reduced scale, shall be plans showing clearly for each deck and hold the boundaries of the watertight compartments, the openings therein with the means of closure and position of any controls thereof, and the arrangements for the correction of any list due to flooding.

(b) Depending upon the extent of necessary information, such booklets may also be required for vessels not on international voyages. In any case, it will be required that any information necessary to compliance with stability and watertight integrity requirements be supplied.

(c) Whenever alterations are made to the vessel so as to materially affect the stability information, amended stability information shall be provided.

## Subpart 74.25—Stability Letter

§ 74.25–1 Posting.

(a) Each vessel subject to the requirements of this part shall have posted under glass in the pilothouse a stability letter issued by U.S. Coast Guard before the vessel is placed in service operation. This letter shall indicate, either by specific instructions embodied in the letter or by reference to separate instructions available to the master, the conditions of operation under which the vessel will have satisfactory stability.

## Subpart 74.90—Vessels Contracted for Prior to May 26, 1965

§ 74.90–1 Requirements.

(a) Vessels contracted for prior to May 26, 1965, shall meet the requirements specified in this section.

(b) Except as otherwise provided in this section, existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they meet the minimum requirements of this section and they are maintained in a suitable condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the original standards.

(c) In general, the standards of stability previously attained should be maintained. In this regard, and particularly with respect to § 74.10–15, no change or modification should result in a lowering of stability farther below that required for a new vessel than existed before the change or modification. This is intended to include the normal additions and subtractions which occur over the life of the vessel.

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# PART 75—LIFESAVING EQUIPMENT

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AUTHORITY: The provisions of this Part 75 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4417, as amended, 4418, as amended, 4426, as amended, 4488, as amended, 4491, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 391, 392, 404, 481, 489, 395, 363, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 6521; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857.

## Subpart 75.01—Application

### § 75.01–1 Details of application.

Except as specifically noted, the provisions of this part shall apply to all vessels.

## Subpart 75.05—General Provisions Pertaining to Lifesaving Equipment

### § 75.05–1 Equipment of an approved type.

(a) Where equipment in this part is required to be of an approved type, such equipment requires the specific approval of the Commandant. Such approvals are published in the FEDERAL REGISTER, and in addition, are contained in Coast Guard publication CG–190, "Equipment Lists."

(b) Specifications for many of the items required to be of an approved type have been promulgated and are contained in Subchapter Q (Specifications) of this chapter. In general, such specifications are of interest only to the manufacturer of specific items of equipment.

### § 75.05–5 Equipment installed but not required.

Where items of lifesaving equipment are not required, but are installed, such equipment and its installation shall meet the requirements of this part.

### § 75.05–10 Primary lifesaving equipment.

(a) The term "primary lifesaving equipment" means a lifeboat or an acceptable substitute. Life preservers and ring life buoys are not included in this definition of "primary lifesaving equipment."

## Subpart 75.10—Lifeboats, Liferafts, Lifefloats, and Buoyant Apparatus

### § 75.10–1 Application.

(a) Except as otherwise provided in this section, the provisions of this subpart shall apply to all vessels contracted for on or after May 26, 1965.

(b) Vessels contracted for prior to May 26, 1965, shall meet the requirements of § 75.10–90.

### § 75.10–5 Type of lifeboats, liferafts, lifefloats, and buoyant apparatus required.

(a) *Lifeboats.* (1) All lifeboats shall be of an approved type, constructed in accordance with Subpart 160.035 of Subchapter Q (Specifications) of this chapter.

(2) All lifeboats certified to carry 60 or more, but not over 100, persons shall be either motor lifeboats or shall be fitted with an approved type of hand-propelling gear. Lifeboats carrying more than 100 persons shall be motor lifeboats.

(3) A Class 1 motor lifeboat is one that is fitted with a compression ignition engine, is capable of being readily started in all conditions, and has sufficient fuel for 24 hours continuous operation. The speed ahead in smooth water when loaded with its full complement of persons and equipment shall be at least 6 knots.

(4) A Class 2 motor lifeboat shall meet the Class 1 requirements, and in addition, shall be fitted with a search light constructed in accordance with Subpart 161.006 of Subchapter Q (Specifications) of this chapter.

(5) A Class 3 motor lifeboat shall meet the Class 2 requirements, and in addition, shall be fitted with a radio cabin and a radio installation complying with requirements of the Federal Communications Commission.

(6) All lifeboats, except those installed on vessels in river service, shall be fitted with suitable disengaging apparatus consisting of fixed hooks in the lifeboat or mechanical disengaging apparatus. Mechanical disengaging apparatus, if fitted, shall be of an approved type, constructed in accordance with Subpart 160.033 of Subchapter Q (Specications) of this chapter.

(i) All lifeboats installed on ocean, coastwise, or Great Lakes vessels of over 3,000 gross tons shall be fitted with mechanical disengaging apparatus so arranged as to make it possible for the lifeboats to be launched with their full complement of persons and equipment while such vessels are underway or stopped, and for both ends of the lifeboat to be released simultaneously, under tension or not, by one person. Simultaneous release shall be effected by partially rotating a shaft which shall be continuous and extend from points of contact with the hooks.

(ii) All lifeboats installed on any particular vessel shall be fitted with the same type of releasing gear.

(b) *Liferafts.* (1) All rigid type liferafts shall be of an approved type, constructed in accordance with Subpart 160.018 of Subchapter Q (Specifications) of this chapter. Rigid type liferafts shall not be used as required equipment on vessels on an international voyage.

(2) Type A liferafts shall be stowed on the standard liferaft skids required by § 75.15–10(c)(1) unless specifically noted otherwise.

(3) All inflatable liferafts shall be of an approved type constructed and serviced in accordance with Subpart 160.051 of Subchapter Q (Specifications) of this chapter.

(4) On vessels on an international voyage, each inflatable liferaft shall have a carrying capacity of not less than 6 nor more than 25 persons.

(c) *Lifefloats.* (1) All lifefloats shall be of an approved type, constructed in accordance with Subpart 160.027 of Subchapter Q (Specifications) of this chapter.

(d) *Buoyant apparatus.* (1) All buoyant apparatus shall be of an approved type, constructed in accordance with Subpart 160.010 of Subchapter Q (Specifications) of this chapter.

(e) *Rescue boat.* (1) In general, a suitable rescue boat shall be a small light weight boat of rigid construction, with built-in buoyancy and capable of being readily launched and easily maneuvered. Also it shall be of adequate proportion to permit taking an unconscious person on board without capsizing. A rescue boat and its installation shall be acceptable to the Officer in Charge, Marine Inspection, as suitable for the rescue of persons accidentally falling over the side, or for similar emergency purposes. The size,

shape, installation, and other factors of suitability will be determined with due consideration of the size, arrangement, intended service and crew requirements of the vessel on which it is to be installed.

**§ 75.10–10 Requirements for vessels in ocean service.**

(a) *Lifeboats.* (1) Except as further noted in this paragraph, all vessels shall be provided with sufficient lifeboats on each side of such aggregate capacity as will accommodate half the total number of persons on board.

(2) Lifeboats shall be not less than 24 feet in length, except where owing to size of the vessel, or for other reasons, the Commandant considers the carriage of such lifeboats to be unreasonable or impracticable. However, in no case shall lifeboats be less than 16 feet in length.

(3) Emergency lifeboats: One of the lifeboats on each side of the vessel shall be of suitable size and design for performing emergency work at sea. Such lifeboats shall be not more than 28 feet in length and the ratio of length to beam shall be not less than 3.3. They shall be kept ready for immediate use while the vessel is at sea.

(4) All vessels shall be provided with the minimum number of motor lifeboats as shown in Table 75.10–10(a)(4). In those cases where at least two motor lifeboats are required, these shall be one on each side. On vessels of over 2,500 gross tons which in the normal course of their voyage are at any point 200 miles offshore, if a Class 3 motor lifeboat is not installed, an approved portable radio unit shall be carried by the vessel in addition to the one required by § 75.55–1.

TABLE 75.10–10(a)(4)

| Total number of persons carried | | Minimum number Class 2 motor lifeboats | Minimum number Class 3 motor lifeboats |
|---|---|---|---|
| Over | Not over | | |
| ------ | 30 | 1 | ---------- |
| 30 | 199 | 2 | ---------- |
| 199 | 1,500 | I | 1 |
| 1,500 | -------- | ---------- | II |

(5) On vessels on an international voyage other than a short international voyage, the Commandant may permit liferafts to be substituted for lifeboats required by subparagraph (1) of this paragraph to the extent that there shall never be less than sufficient lifeboats on each side of the vessel to accommodate 37½ percent of the total number of persons on board. In such cases, there shall be provided approved launching devices for these liferafts in accordance with Subpart 75.27.

(6) Where, in the case of vessels on short international voyages it is shown that the carriage of sufficient lifeboat capacity to accommodate all persons on board, as called for by subparagraph (1) of this paragraph, is impracticable, the Commandant may permit a relaxation from this requirement to the extent permitted by Regulations 27 and 28 of Chapter III of the International Convention for the Safety of Life at Sea, 1960, provided the vessel complies fully with the special watertight subdivision requirements of § 73.10–65 of this subchapter.

(7) Vessels not exceeding 150 feet in length which are under 300 gross tons engaged exclusively in the business of transporting passengers to or from operational sites of exploration, development, removal or storage of resources, or related activities thereof, on the continental shelf of the United States in the Gulf of Mexico, in the Atlantic Ocean south of the thirty-third parallel of north latitude, and in the Pacific Ocean, may use approved lifefloats in lieu of lifeboats if a suitable emergency boat is carried and is adequately installed. For the purpose of this subparagraph the word "passengers" is defined as meaning industry personnel engaged exclusively in the exploration, development, removal and storage of resources, or related activities thereof, on the continental shelf of the United States who are required by the nature of their work to ride such vessels. Vessels subject to this subparagraph may also carry supplies, equipment, and cargo.

(8) For vessels not on an international voyage, inflatable liferafts may be substituted for lifeboats on certain vessels in accordance with § 75.10–25.

(b) *Liferafts, lifefloats, and buoyant apparatus.* (1) Vessels on an international voyage other than a short international voyage shall carry, in addition to any other required equipment, approved liferafts with an aggregate capacity of at least 25 percent of the persons on board together with approved buoyant apparatus with an aggregate capacity of at least 3 percent of the persons on board. However, if the factor of subdivision of the vessel is 0.33 or less, liferafts are not required, but approved buoyant apparatus shall be provided with an aggregate capacity of at least 25 percent of the persons on board.

(2) Vessels on a short international voyage shall carry, in addition to any other required equipment, approved liferafts with an aggregate capacity at least equal to 10 percent of the capacity of the lifeboats. In addition, there shall be carried sufficient approved buoyant apparatus so that the aggregate capacity of the buoyant apparatus and liferafts is at least equal to 25 percent of the persons on board.

(3) All vessels not on an international voyage shall be provided with buoyant apparatus sufficient to accommodate 25 percent of all persons on board. Lifefloats not weighing more than 400 pounds or Type A liferafts may be substituted for the buoyant apparatus required.

(4) Inflatable liferafts may be substituted for liferafts, lifefloats and buoyant apparatus on certain vessels not on an international voyage in accordance with § 75.10–25.

**§ 75.10–15 Requirements for vessels in coastwise service.**

(a) Except as further modified by paragraphs (b) and (d) of this section, all other vessels to which this section pertains shall be provided with sufficient lifeboats and Type A liferafts to accommodate all persons on board. Not less than 75 percent of the total capacity shall be in lifeboats and the remainder may be in liferafts. Such lifeboats shall have a length of at least 16 feet unless otherwise specifically permitted by the Officer in Charge, Marine Inspection, in cases where the crew is insufficient to properly handle lifeboats of such size or where there is insufficient space to properly stow such lifeboats.

(b) In the case of motor vessels of less than 300 gross tons and, if in the opinion of the Commandant it is unreasonable or impracticable to meet the requirements of paragraph (a) of this section, due to the size and arrangement of the vessel and its intended service, the Commandant may prescribe the size, capacity, and number of lifeboats, or other boats of suitable design and construction, liferafts, lifefloats, and/or buoyant apparatus to be carried as in his opinion is reasonable and practicable. In any case, there shall be sufficient total capacity for all persons on board.

(c) Inflatable liferafts may be substituted for lifeboats, liferafts, lifefloats and buoyant apparatus on certain vessels in accordance with § 75.10–25.

(d) Vessels engaged on international voyages shall meet the applicable requirements of § 75.10–10.

**§ 75.10–20 Requirements for vessels in Great Lakes; lakes, bays and sounds; or river service.**

(a) *General.* All vessels other than ferryboats and passenger barges shall be provided with lifeboats, liferafts, and lifefloats as required by Table 75.10–20(a), except as specifically noted in this paragraph.

(1) Motor vessels of less than 50 gross tons, navigating in daylight only, need not be fitted with lifeboats, liferafts, or lifefloats, provided:

(i) Such vessels are fitted with sufficient air tanks under the decks that the vessel, in its loaded condition, will remain afloat when full of water; or

(ii) Such vessels are fitted with sufficient bulkheads that the vessel, in its loaded condition, will remain afloat with any two compartments damaged.

(2) In the case of a motor vessel in Great Lakes service of less than 300 gross tons, if in the opinion of the Commandant it is unreasonable or impracticable to install the lifeboats, liferafts, or other equipment required by Table 75.10–20(a) due to the size and arrangement of the vessel and its intended service, the Commandant may prescribe the size, capacity, and number of lifeboats or other boats of suitable design and construction, life rafts, and/or life floats to be carried as in his opinion is reasonable and practicable. In any case, there shall be at least one lifeboat or other suitable boat, and there shall be sufficient total capacity for the percentage of all persons on board required to be accommodated by Table 75.10–20(a).

TABLE 75.10-20(a)

| | Vessels operating on the Great Lakes | | | | Vessels operating on lakes, bays, and sounds | | | | | | | | | Vessels operating on rivers | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Vessels navigating more than 3 miles off shore and where the depth of water on any part of the route is sufficient to submerge the upper deck of the vessel | | 1. Vessels navigating not more than 3 miles offshore; or 2. Vessels navigating routes where the water is not of a depth on any part of the route to submerge the upper deck of the vessel | | Vessels navigating waters other than those tributary to the Pacific Coast of the continental United States, the Atlantic Coast south of the thirty-third parallel of north latitude, and the Gulf of Mexico | | | | | | Vessels navigating waters tributary to the Pacific Coast of the continental United States, the Atlantic Coast south of the thirty-third parallel of north latitude, and the Gulf of Mexico | | | Vessels navigating where the average depth of the channel exceeds 3 feet | Vessels navigating where the average depth of the channel does not exceed 3 feet |
| | | | | | Vessels navigating routes, any point of which is more than 3 miles from land, and— | | | | Vessels navigating routes lying at all points within a distance of 3 miles miles from land | | Vessels navigating routes, any point of which is more than 3 miles from land, and— | | Vessels navigating routes lying at all points within a distance of 3 miles from land | | |
| | | | | | 1. Depth of water is sufficient to entirely submerge the vessel in case of disaster | | 2. Depth of water is not sufficient to entirely submerge the vessel in case of disaster | | | | 1. Depth of water is sufficient to entirely submerge the vessel in case of disaster | 2. Depth of water is not sufficient to entirely submerge the vessel in case of disaster | | | |
| Dates (inclusive) | Winter Sept. 16 to May 14 | Summer May 15 to Sept. 15 | Winter Sept. 16 to May 14 | Summer May 15 to Sept. 15 | Winter Oct. 16 to May 14 | Summer May 15 to Oct. 15 | Winter Nov. 16 to Apr. 14 | Summer Apr. 15 to Nov. 15 | Winter Nov. 16 to Apr. 14 | Summer Apr. 15 to Nov. 15 | All year | All year | All year | All year | All year |
| Percentage of persons (passengers and crew) to be accommodated | Percent 100 | Percent 50 | Percent 100 | Percent 10 | Percent [1] 100 | Percent [2] 30 | Percent 100 | Percent 10 | Percent 100 | Percent 10 | Percent [2] 30 | Percent 10 | Percent 10 | Percent 10 | Percent None |
| Percentage of required equipment in lifeboats (minimum) | [3] 75 | [4] 40 | [3] 25 | [3] 25 | [3] 25 | [3] 25 | [3] 25 | [3] 25 | [3] 25 | [3] 25 | [3] 25 | [3] 25 | [3] 25 | [4] 25 | [4] None |
| Percentage of required equipment which may be in Type A or Type B liferafts | [5] [6] 25 | [5] [7] 60 | [5] [6] 75 | [5] [7] 75 | [5] [6] 75 | [5] [6] 75 | [5] [6] 75 | [5] [6] 75 | [5] [6] 75 | [5] [6] 75 | [5] [6] 75 | [5] [6] 75 | [6] 75 | [6] 75 | None |

[1] Vessels equipped with radiotelegraph or radiotelephone operating in daylight only and when routes are at all times within a distance of 10 miles from land may, during the interval between the 16th day of October to the 31st day of October, both dates inclusive, carry primary lifesaving equipment to accommodate not less than 30 percent of all persons on board.

[2] Vessels equipped with radiotelegraph or radiotelephone operating in daylight only and whose routes are at all times within a distance of 10 miles from land may, during the interval between the 15th day of May to the 15th day of October, both dates inclusive, carry primary lifesaving equipment to accommodate not less than 15 percent of all persons on board.

[3] Vessels of 200 gross tons and upward shall have 1 working boat with lifeline attached, properly supplied with oars and painter, and kept in good condition at all times and ready for immediate use, in addition to the lifeboats required.

[4] Vessels of 50 gross tons and upward in river service shall have 1 working boat with lifeline attached, properly supplied with oars and painter, and kept in good condition at all times and ready for immediate use, in addition to any lifeboats required.

[5] At least 50 percent of the liferafts shall have a capacity of more than 15 persons each.

[6] Vessels shall have, in addition to all other lifeboats and liferafts required; 1 additional fully equipped Type A or Type B liferaft which shall be stowed (not necessarily on skids) in such a manner that it will float clear in the event of sinking of the vessel. On all vessels of 300 gross tons and over the liferaft shall be not less than 15-person capacity.

[7] Approved lifefloats may be substituted for liferafts on vessels during the interval between May 15 and September 15 in any 1 year, both dates inclusive.

[8] Approved lifefloats may be substituted for liferafts on vessels operated south of the thirty-third parallel of north latitude, and on vessels operated north of the thirty-third parallel of north latitude during the interval between the 15th day of May to the 15th day of October, in any 1 year, both dates inclusive.

[9] Approved lifefloats may be substituted for liferafts.

(3) In the case of vessels of less than 300 gross tons in lakes, bays, sounds, or river service, if in the opinion of the Commandant it is unreasonable or impracticable to install the lifeboats, liferafts, or other equipment required by Table 75.10-20(a) due to the size and arrangement of the vessel and its intended service, the Commandant may prescribe the size, capacity, and number of lifeboats or other boats of suitable design and construction, liferafts, and/or lifefloats to be carried as in his opinion is reasonable and practicable. In any case there shall be at least one lifeboat or other suitable boat, and there shall be sufficient total capacity for the percentage of all persons on board required to be accommodated by Table 75.10-20(a).

(4) Inflatable liferafts may be substituted for lifeboats, liferafts, lifefloats and buoyant apparatus on certain vessels in accordance with § 75.10-25.

(5) Vessels engaged on short international voyages shall meet applicable requirements of § 75.10-10.

(b) *Ferryboats.* (1) Except as otherwise provided in this paragraph, all ferryboats of 50 gross tons and over shall be equipped with lifeboats and liferafts in accordance with Table 75.10-20(b)(1).

TABLE 75.10-20(b)(1)

| Size of ferryboat in gross tons | | Cubic feet of lifeboatage required [1] |
|---|---|---|
| Over | Not over | |
| ---------- | 150 | 60 |
| 150 | 300 | 120 |
| 300 | 600 | [2] 240 |
| 600 | ---------- | [2] 360 |

[1] For purposes of determining lifeboat capacity in persons for use in substituting inflatable liferafts in accordance with substitutions permitted by §75.10-25, allow 10 cubic feet of lifeboatage per person.

[2] One-half of the required lifeboatage may be supplied by liferafts of Type A or B.

(2) Except as otherwise provided in this paragraph, ferryboats of less than 50 gross tons shall be equipped with lifeboats or Type A or B liferafts as in the opinion of the Officer in Charge, Marine Inspection, having jurisdiction may be necessary in case of disaster to secure the safety of all persons on board.

(3) Inflatable liferafts may be substituted for lifeboats, liferafts, lifefloats and buoyant apparatus on certain vessels in accordance with § 75.10-25.

(4) Ferryboats engaged on short international voyages shall meet the applicable requirements of § 75.10-10.

(c) *Passenger barges.* (1) Passenger barges shall be provided with lifeboats or other boats of suitable design and construction of a capacity in the same proportion to the number of persons carried as is required by Table 75.10-20(a).

(2) Passenger barges engaged in excursions shall be provided with 2 lifeboats or other boats of suitable design and construction of not less than 60 cubic feet capacity each.

(3) Inflatable liferafts may be substituted for lifeboats, liferafts, lifefloats and buoyant apparatus on certain vessels in accordance with § 75.10-25.

**§ 75.10–25 Inflatable liferafts as an alternate for lifeboats, other liferafts, lifefloats, and buoyant apparatus on certain vessels not on international voyage.**

(a) (1) On all vessels inflatable liferafts may be permitted as substitutes for other types of liferafts, lifefloats and buoyant apparatus wherever they may be required.

(2) The capacity of inflatable liferafts carried in place of other liferafts, lifefloats, and buoyant apparatus shall be at least equivalent to that required of the equipment for which substitution is made.

(3) The substitution of inflatable liferafts shall not be made without prior approval of the Officer in Charge, Marine Inspection.

(b) On all vessels less than 3,000 gross tons the substitution of inflatable liferafts for lifeboats may be permitted as follows:

(1) (i) On all vessels under 500 gross tons, inflatable liferafts may be substituted for all required lifeboats.

(ii) The total capacity of the inflatable liferafts shall be at least equal to the total number of persons that the lifeboats would have been required to accommodate. Partial substitution is permissible provided the aggregate lifeboat and inflatable liferaft capacity is sufficient to accommodate the required number of persons, as indicated above.

(iii) Where substitution of inflatable liferafts is made, a suitable rescue boat shall be provided. In the case of partial substitution, a lifeboat may serve as the rescue boat.

(2) (i) On all vessels of 500 gross tons and upwards to 1,600 gross tons, inflatable liferafts may be substituted for all required lifeboats provided two approved lifeboats of a size acceptable to the Officer in Charge, Marine Inspection, suitable for rescue purposes, one on each side, are installed.

(ii) The aggregate lifeboats and inflatable liferaft capacity shall be at least equal to the total number of persons that the lifeboats would have been required to accommodate.

(iii) The launching arrangement and location of the two lifeboats to be used as rescue boats shall be such that they can be readily launched and shall be to the satisfaction of the Officer in Charge, Marine Inspection.

(3) (i) On all vessels of 1,600 gross tons and upwards to 3,000 gross tons, inflatable liferafts may be substituted for all except two of the required lifeboats. These lifeboats shall be of a size acceptable to the Officer in Charge, Marine Inspection, and shall be suitable for rescue purposes. In all cases, two approved lifeboats, one on each side, shall be provided.

(ii) The aggregate lifeboat and inflatable liferaft capacity shall be at least equal to the total number of persons that the lifeboats, for which substitutions are made plus those remaining on board, would have been required to accommodate.

(4) The substitution of inflatable liferafts for lifeboats shall not be made without prior approval of the Officer in Charge, Marine Inspection.

(c) The Commandant may give special consideration to the substitution of approved inflatable liferafts for required lifeboats on vessels of 3,000 gross tons and over.

**§ 75.10–90 Vessels contracted for prior to May 26, 1965.**

(a) Vessels contracted for prior to May 26, 1965, shall meet the following requirements:

(1) Except as specifically modified by this paragraph, the requirements of §§ 75.10–5 through 75.10–25 shall be complied with insofar as the number and general type of lifesaving equipment is concerned. Existing items of lifesaving equipment previously approved, but not meeting the applicable specifications or requirements set forth in §§ 75.10–5 through 75.10–25 may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs, alterations, and replacements may be permitted to the same standards as the original installation. However, all new installations or major replacements shall meet the applicable specifications or requirements in this part.

(2) Vessels certificated for ocean service may comply with this subparagraph in lieu of subparagraph (4) of this paragraph. In this respect, vessels with 13 or less lifeboats shall have at least one motor lifeboat; vessels with over 13 but not over 19 lifeboats shall have 2 motor lifeboats, one of which shall have a searchlight and radio cabin; vessels with over 19 lifeboats shall have 2 motor lifeboats, both of which shall have a searchlight and radio cabin. If a vessel with 13 or less lifeboats is of over 2,500 gross tons and in the normal course of its voyage is at any point 200 miles offshore, the motor lifeboat shall be fitted with a radio cabin, or alternately, an approved portable radio unit shall be carried by the vessel in addition to that required by § 75.55–1. Existing motor lifeboat installations with spark ignition engines may be retained, but replacements shall meet current specifications.

(3) The substitution of liferafts for lifeboats permitted by § 75.10–10(a) (5) and (6) shall not apply.

(4) On vessels of over 3,000 gross tons certificated for ocean, coastwise, or Great Lakes service, all replacements of disengaging apparatus shall meet the requirements of § 75.10–5(a) (6) (i). On all other vessels in any service, all of the lifeboats on a particular vessel shall be fitted with the same type of disengaging apparatus.

(5) Vessels certificated for coastwise service the keels of which were laid prior to July 2, 1915, during the interval between May 15 and September 15 in any one year, both dates inclusive, shall have sufficient lifeboats, liferafts, or buoyant apparatus to accommodate all persons on board, not more than 30 percent of which may be in buoyant apparatus and not more than a total of 65 percent may be in liferafts and buoyant apparatus.

## Subpart 75.15—Stowage and Marking of Lifeboats, Liferafts, Lifefloats, and Buoyant Apparatus

**§ 75.15–1 Application.**

(a) The provisions of this subpart, with the exception of § 75.15–90, shall apply to all vessels contracted for on or after May 26, 1965. Vessels contracted for prior to May 26, 1965, shall meet the requirements of § 75.15–90.

**§ 75.15–5 General.**

(a) The lifeboats, liferafts, lifefloats, and buoyant apparatus shall be readily available in case of emergency, and shall be kept in good working order and available for immediate use at all times when the vessel is being navigated and, insofar as reasonable and practicable, while the vessel is not being navigated. The emergency lifeboats required by § 75.10–10 (a) (3) shall have their sea painters passed along forward on the vessel when at sea.

(b) The decks on which lifeboats, liferafts, lifefloats, and buoyant apparatus are carried shall be kept clear of freight or any other obstructions which would interfere with the immediate launching of the lifesaving appliance.

**§ 75.15–10 Stowage.**

(a) Lifeboats, liferafts, lifefloats, and buoyant apparatus shall be stowed in such a manner that:

(1) They are capable of being launched in the shortest possible time.

(2) They shall not impede the launching or handling of other lifesaving appliances.

(3) They shall not impede the marshalling of persons at the embarkation stations, or their embarkation.

(4) They shall be capable of being put in the water safely and rapidly even under unfavorable conditions of list and trim.

(b) Lifeboat stowage shall be as follows:

(1) Every lifeboat shall be attached to a separate set of davits.

(2) Suitable access to the lifeboats shall be provided to enable the crew to prepare the lifeboats for launching.

(3) Lifeboats shall be so stowed that embarkation into them may be made rapidly and in good order.

(4) Lifeboats shall not be stowed in the bows of the vessel nor as far aft as to be endangered by the propellers or overhang of the stern.

(5) Lifeboats shall be so stowed that it shall not be necessary to lift them in order to swing out the davits.

(6) Lifeboats may be stowed on more than one deck, provided proper measures are taken to prevent lifeboats on a lower deck being fouled by those stowed on a deck above.

(7) Means shall be provided for bringing the lifeboats against the ship's side and holding them there so that persons may be safely embarked.

(8) Vessels in ocean or coastwise service shall be fitted with skates or other suitable means to facilitate launching against an adverse list of up to 15 degrees. However, skates may be dispensed with if, in the opinion of the

Commandant, the arrangements are such as to insure that the lifeboats can be satisfactorily launched without such skates.

(9) Ocean and coastwise vessels fitted with radial davits shall, when the weather permits, have one of the lifeboats on each side swung out while at sea, griped in to a boom or rail, and ready for immediate use.

(10) On vessels in ocean and coastwise service, where applicable, means shall be provided outside the machinery space to prevent the discharge of water into the lifeboats while they are being lowered. This shall consist of baffles to deflect the water down the vessel's side, or reach rods, or other means to close the discharge openings.

(c) Liferaft stowage shall be as follows:

(1) Liferafts for which approved launching devices are required shall be distributed equally on each side of the ship and shall be stowed so as to be readily accessible to the launching device which serves them. They shall not be stowed in the bows of the vessel nor as far aft as to be endangered by the propellers or overhang of the stern. Such liferafts shall be capable of being put into the water loaded with their full complement of persons and equipment even with unfavorable conditions of trim and a list of 15 degrees either way.

(2) Means shall be provided outside the machinery space to prevent discharge of water into liferafts launched at fixed positions or from approved launching devices.

(3) The liferafts for which approved launching devices are not required shall be capable of being launched even with unfavorable conditions of trim and a list of 15 degrees either way.

(4) On vessels fitted with approved devices for launching liferafts, all liferafts shall be of a size and type which is capable of being launched from such devices.

(5) Type A liferafts shall be stowed on standard skids constructed in accordance with Subpart 160.042 of Subchapter Q (Specifications) of this chapter.

(6) Type B liferafts shall be stowed in such a manner that they may be readily launched.

(7) The additional liferaft required on Great Lakes vessels by Table 75.10-20(a) shall be stowed in such a manner that it will float clear in the event of sinking of the vessel. The requirements of the other subparagraphs in this paragraph need not be complied with for such liferaft.

(8) Inflatable liferafts shall be stowed in such a manner that they will float free in the event of the vessel sinking. Stowage and launching arrangements will be to the satisfaction of the Officer in Charge, Marine Inspection.

(d) Lifefloat and buoyant apparatus stowage shall be as follows:

(1) Lifefloats and buoyant apparatus shall be stowed in such a manner as to be readily launched. Lifefloats and buoyant apparatus exceeding 400 pounds in weight shall be stowed in such a manner as not to require lifting before launching.

(2) Lifefloats and buoyant apparatus shall not be secured to the vessel except by lashings which can be easily slipped. They may be stowed in tiers one above the other, but not more than four high. When stowed in tiers, the separate units shall be kept apart by suitable distance pieces.

(3) Means shall be provided to prevent shifting.

### § 75.15-15 Marking.

(a) Lifeboats, liferafts, lifefloats, and buoyant apparatus shall be marked as required by §§ 78.47-60 and 78.47-63 of this subchapter.

### § 75.15-90 Vessels contracted for prior to May 26, 1965.

(a) Vessels contracted for prior to May 26, 1965, shall meet the following requirements:

(1) The provisions of §§ 75.15-5 through 75.15-15 shall be met except as further set forth in this paragraph.

(2) The requirements of § 75.15-10(b) (8) shall apply unless, in the opinion of the Officer in Charge, Marine Inspection, it is unreasonable or impracticable or the arrangements or construction of the vessel make the use of skates or similar appliances unnecessary.

(3) The requirements of § 75.15-10(b) (10) need only apply if it is deemed reasonable and practicable by the Officer in Charge, Marine Inspection.

(4) Existing vessels having nested lifeboats may continue such arrangements. However, no subsequent modification, replacement, or rearrangement may result in a greater capacity in the nested lifeboats nor a greater number of persons being permitted aboard the vessel.

## Subpart 75.20—Equipment for Lifeboats, Liferafts, Lifefloats, and Buoyant Apparatus

### § 75.20-1 Application.

(a) The provisions of this subpart, with the exception of § 75.20-90, shall apply to all vessels contracted for on or after May 26, 1965. Vessels contracted for prior to May 26, 1965, shall meet the requirements of § 75.20-90.

### § 75.20-5 General.

(a) Equipment for lifeboats, liferafts, lifefloats, and buoyant apparatus shall be of good quality, efficient for the purpose they are intended to serve, and kept in good condition.

(b) Lifeboats, liferafts, lifefloats, and buoyant apparatus shall be fully equipped before the vessel is navigated and the equipment shall remain in such lifesaving appliances throughout the voyage. In any case, such lifesaving appliances shall be fully equipped at all times when passengers are on board.

(c) It shall be unlawful to stow in any lifeboat, liferaft, lifefloat or buoyant apparatus, any article not required by this subpart unless such article can be properly stowed so as not to reduce the seating capacity or space available to the occupants and so as not to adversely affect the seaworthiness of such appliances or, in the case of lifeboats, overload the davits or winches.

(d) Loose equipment, except boat hooks in lifeboats, shall be securely attached to the lifesaving appliance to which it belongs.

### § 75.20-10 Required equipment for lifeboats.

(a) The lifeboats for all vessels shall be equipped in accordance with Table 75.20-10(a). For a description of the items contained in this table, and the units comprising the items, see the applicable paragraphs of § 75.20-15. The letter identification prefixing the item in the table corresponds to the paragraph designations in § 75.20-15.

TABLE 75.20-10(a)

| Letter identification | Item | Ocean and coastwise | Great Lakes | Lakes, bays and sounds, and rivers |
|---|---|---|---|---|
| a | Bailer | 1 | 1 | None |
| b | Bilge pump | [1] 1 | None | None |
| c | Boathooks | 2 | 1 | 1 |
| d | Bucket | 2 | 1 | 1 |
| e | Compass and mounting | 1 | None | None |
| f | Ditty bag | 1 | None | None |
| g | Drinking cups | 1 | None | None |
| h | Fire extinguishers (motor-propelled lifeboats only). | 2 | 2 | 2 |
| i | First aid kit | 1 | None | None |
| j | Flashlight | 1 | 1 | None |
| k | Hatchets | 2 | 2 | 1 |
| l | Heaving line | 2 | None | None |
| m | Jackknife | 1 | None | None |
| n | Ladder, lifeboat gunwale | 1 | None | None |
| o | Lantern | 1 | 1 | 1 |
| p | Lifeline | 1 | 1 | 1 |
| q | Life preservers | 2 | 2 | 2 |
| r | Locker | 1 | 1 | None |
| s | Mast and sail (oar-propelled lifeboats only) | 1 | None | None |
| t | Matches (boxes) | 2 | 1 | 1 |
| u | Milk, condensed (pounds per person) | 1 | None | None |
| v | Mirrors, signaling | 2 | None | None |
| w | Oars | [1] 1 unit | [2] 1 unit | [2] 1 unit |
| x | Oil, illuminating (quarts) | 1 | 1 | None |
| y | Oil, storm (gallons) | 1 | 1 | None |
| z | Painter | 2 | 2 | 1 |
| aa | Plugs | 1 | 1 | 1 |
| bb | Provisions (pounds per person) | 2 | None | None |
| cc | Radio installation | [3] 1 | None | None |
| dd | Rowlocks | [2] 1 unit | [2] 1 unit | [2] 1 unit |

See footnotes at end of table.

TABLE 75.20-10(a)—Continued

| Letter identification | Item | Ocean and coastwise | Great Lakes | Lakes, bays and sounds, and rivers |
|---|---|---|---|---|
| ee | Rudder and tiller | 1 | 1 | None |
| ff | Sea anchor | 1 | 1 | None |
| gg | Searchlight | [3] 1 | None | None |
| hh | Signals, distress, floating orange smoke | 2 | None | None |
| ii | Signals, distress, red hand flare | [2] 1 unit | [2] ½ unit | None |
| jj | Signals, distress, red parachute flare | [2] [4] 1 unit | [2] 1 unit | None |
| kk | Tool kit (motor-propelled lifeboats only) | [2] 1 unit | [2] 1 unit | [2] 1 unit |
| ll | Water (quarts per person) | 3 | None | None |
| mm | Whistle, signaling | 1 | None | None |
| nn | Fishing kit | 1 | None | None |
| oo | Cover, protecting | 1 | None | None |
| pp | Signals, lifesaving | 1 | None | None |
| qq | Desalting kit | [5] 1 | None | None |

[1] Motor-propelled lifeboats, certified for 100 or more persons, shall be fitted with an additional hand bilge pump of an approved type or a power bilge pump.
[2] For description of units, see § 75.20-15.
[3] Required only on motor-propelled lifeboats fitted with radio cabin, see § 75.10-5(a)(5).
[4] Vessels in coastwise service need only carry 1 unit for each 5 lifeboats or fraction thereof.
[5] Optional equipment. See § 75.20-15(11), water.

**§ 75.20-15 Description of equipment for lifeboats.**

(a) *Bailer.* The bailer shall have a lanyard attached and shall be of sufficient size and suitable for bailing.

(b) *Bilge pump.* Bilge pumps shall be of an approved type, constructed in accordance with Subpart 160.044 of Subchapter Q (Specifications) of this Chapter. They shall be of the size given in Table 75.20-15 (b) depending upon the capacity of the lifeboat as determined by the six-tenths rule as described in § 160.035-8 (b) of Subchapter Q (Specifications) of this chapter.

TABLE 75.20-15 (b)

| Capacity of lifeboat cubic feet | | Bilge pump size |
|---|---|---|
| Over | Not over | |
| ---------- | [illegible] | 1 |
| 330 | 700 | 2 |
| 700 | ---------- | 3 |

(c) *Boathooks.* Boathooks shall be of the single hook ball point type. Boathook handles shall be of clear grained white ash, or equivalent, and of a length and diameter as given in Table 75.20-15(c).

TABLE 75.20-15 (c)

| Length of lifeboat, feet | | Boathook handles | |
|---|---|---|---|
| Over | Not over | Diameter, inches | Length, feet |
| ------ | [illegible] | 1¼ | 8 |
| 23 | [illegible] | 1¾ | 10 |
| 29 | ------ | 2 | 12 |

(d) *Bucket.* The bucket shall be of heavy gage galvanized iron, or other suitable corrosion resistant metal, of not less than 2 gallons capacity, and shall have a 6-foot lanyard of 12 thread manila attached.

(e) *Compass and mounting.* The compass and mounting shall be of an approved type constructed in accordance with United States Coast Guard specification dated December 14, 1944.

(f) *Ditty bag.* The ditty bag shall consist of a canvas bag and shall contain a sailmaker's palm, needles, sail twine, marline, and marline spike.

(g) *Drinking cups.* Drinking cups shall be enamel coated or plastic, graduated in ounces, and be provided with lanyards 3 feet in length.

(h) *Fire extinguisher.* Fire extinguishers shall be of approved Type B-C, Size I (see § 76.50-5 of this subchapter). One shall be attached to each end of the lifeboat.

(i) *First aid kit.* The first aid kit shall be of an approved type, constructed and fitted in accordance with Subpart 160.041 of Subchapter Q (Specifications) of this chapter.

(j) *Flashlight.* The flashlight shall be of an approved Type I, Size No. 3, constructed in accordance with Subpart 161.008 of Subchapter Q (Specifications) of this chapter. Three spare cells (or one 3-cell battery) and two spare bulbs, stowed in a watertight container, shall be provided with each flashlight. Batteries shall be replaced yearly during the annual stripping, cleaning, and overhaul of the lifeboat.

(k) *Hatchet.* Hatchets shall be of an approved type, constructed in accordance with Subpart 160.013 of Subchapter Q (Specifications) of this chapter. They shall be attached to the lifeboat by individual lanyards and be readily available for use, one at each end of the lifeboat.

(l) *Heaving line.* The heaving line shall be of adequate strength, 10 fathoms in length, and 1 inch in circumference. It shall be of such quality as to be buoyant after 24 hours submergence.

(m) *Jackknife.* The jackknife (with can opener) shall be of an approved type, constructed in accordance with Subpart 160.043 of Subchapter Q (Specifications) of this chapter.

(n) *Ladder, lifeboat gunwale.* The lifeboat gunwale ladder shall consist of 3 flat wood steps cut out for hand holds. The steps shall be spaced 12 inches apart and fastened with ⅝ inch-diameter manila rope. Each rope end shall be tied inside the lifeboat at about amidships with the ladder stowed on top of the side benches and ready for immediate use. Other suitable devices may be specifically approved.

(o) *Lantern.* The lantern shall contain sufficient oil to burn for at least 9 hours, and shall be ready for immediate use.

(p) *Lifeline.* The lifeline shall be properly secured to both sides of the lifeboat along its entire length, festooned in bights not longer than 3 feet, with a seine float in each bight, which float may be omitted if the line is of an inherently buoyant material and absorbs little or no water. The lifeline shall be of a size and strength not less than ⅜-inch diameter manila. The bights shall hang to within 12 inches of the water when the lifeboat is light.

(q) *Life preservers.* Life preservers shall be of an approved type, constructed in accordance with the applicable subparts of Subchapter Q (Specifications) of this chapter.

(r) *Locker.* The locker shall be suitable for the storage and preservation of the small items of equipment.

(s) *Mast and sail.* A unit, consisting of a standing lug sail together with the necessary spars and rigging, shall be provided in general agreement with Table 75.20-15 (s). The sails shall be of good quality canvas, colored Indian Orange (Cable No. 70072, Standard Color Card of America). Rigging shall consist of galvanized wire rope not less than 5/16 inch in diameter. The sail and gear shall be protected by a suitable canvas cover.

TABLE 75.20-15 (s)

| Length of lifeboat, feet | | Standing lug sail | | | | | | | Mast [1] | | Yard [1] | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Over | Not over | Area square feet | Luff and head length | Leach length | Foot length | Clew to throat | Ounces per square yard | Commercial designation number | Length | Diameter | Length | Diameter |
| | | | ft. in. | ft. in. | ft. in. | ft. in. | | | ft. in. | in. | ft. in. | in. |
| ---------- | 17 | 68 | 5 11 | 12 1 | 8 10 | 10 10 | 14.35 | 10 | 11 2 | 3 | 6 11 | 2 |
| 17 | 19 | 74 | 6 8 | 13 8 | 10 0 | 12 2 | 14.25 | 10 | 12 6 | 3 | 7 8 | 2 |
| 19 | 21 | 98 | 7 5 | 15 1 | 11 2 | 13 8 | 14.35 | 10 | 13 10 | 3¼ | 8 5 | 2½ |
| 21 | 23 | 113 | 8 3 | 16 11 | 12 4 | 15 1 | 14.35 | 10 | 14 2 | 3½ | 9 3 | 2½ |
| 23 | 25 | 133 | 9 0 | 18 6 | 13 6 | 16 6 | 14.33 | 10 | 16 6 | 4 | 10 0 | 3 |
| 25 | 27 | 158 | 9 9 | 20 0 | 14 7 | 17 10 | 17.50 | 8 | 17 10 | 4 | 10 9 | 3 |
| 27 | 29 | 181 | 10 5 | 21 8 | 15 7 | 19 1 | 17.50 | 8 | 19 2 | 4½ | 11 5 | 3¼ |
| 29 | 31 | 203 | 11 0 | 22 8 | 16 6 | 20 3 | 20.74 | 6 | 20 6 | 4½ | 12 0 | 3½ |
| 31 | [2] | [2] | [2] | [2] | [2] | [2] | [2] | [2] | [2] | [2] | [2] | [2] |

[1] Mast lengths measured from heel to center of upper halyard sheave. Mast diameters measured at thwart. Mast and yard shall be of clear grained spruce, fir, or equivalent.
[2] Subject to special consideration.

(t) *Matches.* A box of friction matches in a watertight container stowed in an equipment locker or secured to the underside of the stern thwart if no locker is fitted.

(u) *Milk, condensed.* One pound of condensed milk shall be provided for each person the lifeboat is certified to carry, to be stowed in lockers or other compartments providing suitable protection.

(v) *Mirrors, signaling.* Signaling mirrors shall be of an approved type.

(w) *Oars.* A unit, consisting of a complement of rowing oars and a steering oar, shall be provided for each lifeboat in accordance with Table 75.20–15 (w), except that motor-propelled and hand-propelled lifeboats need only be equipped with 4 rowing oars and 1 steering oar. In any case, the emergency lifeboats shall be provided with the full complement of oars prescribed by the table. All oars shall be buoyant.

TABLE 75.20–15 (w)

| Length of lifeboat, feet | | Number of oars | | Length of oars, feet | |
|---|---|---|---|---|---|
| Over | Not over | Rowing | Steering | Rowing | Steering |
| ---- | 15 | 4 | 1 | 8 | 9 |
| 15 | 19 | 5 | 1 | 10 | 11 |
| 19 | 21 | 6 | 1 | 11 | 12 |
| 21 | 23 | 6 | 1 | 12 | 13 |
| 23 | 25 | 6 | 1 | 13 | 14 |
| 25 | 27 | 6 | 1 | 14 | 15 |
| 27 | ---- | 8 | 1 | 15 | 16 |

(x) *Oil, illuminating.* One quart of illuminating oil shall be provided in a metal container.

(y) *Oil, storm.* One gallon of vegetable, fish, or animal oil shall be provided in a suitable metal container so constructed as to permit a controlled distribution of oil on the water, and so arranged that it can be attached to the sea anchor.

(z) *Painter.* Painters shall be of manila rope not less than 2¾ inches in circumference, or equivalent, and of a length not less than 3 times the distance between the deck on which the lifeboat is stowed and the light draft of the vessel. For lifeboats on vessels in ocean, coastwise, or Great Lakes service one of the painters shall have a long eye splice and shall be attached to the thwart with a toggle. The other painter shall be attached to the stem.

(aa) *Plug.* The automatic drain plug required in the lifeboat shall be provided with a cap or plug attached to the lifeboat by a suitable chain.

(bb) *Provisions.* Two pounds of hard bread or its approved equivalent shall be provided for each person the lifeboat is certified to carry. The provisions shall be packaged in hermetically sealed cans of an approved type. The cans shall be stowed in lockers or other compartments providing suitable protection.

(cc) *Radio installation.* The radio installation shall comply with the requirements of the Federal Communications Commission.

(dd) *Rowlocks.* A unit, consisting of sufficient rowlocks and rowlock sockets for each oar required by Table 75.20–15 (w) plus two additional rowlocks. The rowlocks shall be attached to the lifeboat by separate chains so as to be available for immediate use, except that the two additional spare rowlocks shall be carried in the equipment locker or stowed near the stern if no locker is fitted. The rowlocks and rowlock sockets shall be distributed so as to provide the maximum amount of single banked oars practicable.

(ee) *Rudder and tiller.* The rudder and tiller shall be constructed in accordance with § 160.035–3 (t) in Subpart 160.035 of Subchapter Q (Specifications) of this chapter.

(ff) *Sea anchor.* The sea anchor shall be of an approved type.

(gg) *Searchlight.* The searchlight shall be of an approved type, constructed in accordance with Subpart 161.006 of Subchapter Q (Specifications) of this chapter. If installed on a lifeboat equipped with a radio cabin, it shall be securely mounted to the top of the radio cabin and its source of power shall be capable of operating the light intermittently (10 minutes of continuous operation per hour) for a period of at least 3 hours. Where the power for the radio equipment and the searchlight are derived from the same source, it shall be sufficient to provide for adequate operation of both appliances. On lifeboats without a radio cabin, means shall be provided to mount it readily. The mounting may be of a portable type (stanchion type or collapsible type). The source of power shall be connected with watertight electrical fittings as required in Subpart 111.60 of Subchapter J (Electrical Engineering) of this chapter. When not in use, it shall be securely stowed safely, free from any possible damage. Two spare bulbs shall be provided with each installation.

(hh) *Signals, distress, floating orange smoke.* Two approved floating orange smoke distress signals, constructed in accordance with Subpart 160.022 of Subchapter Q (Specifications) of this chapter. The service use of this equipment shall be limited to three years from date of manufacture, and replacement shall be made no later than the first annual inspection of the vessel after the date of expiration.

(ii) *Signals, distress, red hand flare.* A unit, consisting of twelve approved hand red flare distress signals in a watertight container, constructed in accordance with Subpart 160.021 or Subpart 160.023 of Subchapter Q (Specifications) of this chapter. The service use of this equipment shall be limited to three years from date of manufacture, and replacement shall be made no later than the first annual inspection of the vessel after the date of expiration.

(jj) *Signals, distress, red parachute flare.* A unit, consisting of twelve approved parachute red flare distress signals, with an approved means of projecting them, all contained in a portable watertight container; or twelve approved hand-held rocket-propelled parachute red flare distress signals contained in a portable watertight container. Construction shall be in accordance with Subparts 160.024 and 160.028 or Subpart 160.036 of Subchapter Q (Specifications) of this chapter. The service use of this equipment shall be limited to three years from date of manufacture, and replacement shall be made no later than the first annual inspection of the vessel after the date of expiration.

(kk) *Tool kit.* The tool kit shall consist of at least the following tools contained in a suitable container:

(1) One 12-ounce ball peen hammer.

(2) One screwdriver with 6-inch blade.

(3) One pair 8-inch slip joint pliers.

(4) One 8-inch adjustable end wrench.

(ll) *Water.* (1) For each person the lifeboat is certified to carry, there shall be provided 3 quarts of drinking water consisting of nine approved hermetically sealed containers per person constructed and filled in accordance with Subpart 160.026 of Subchapter Q (Specifications) of this chapter. The service life of this equipment shall be limited to 5 years from date of packing, and replacement of outdated containers shall be made at the first annual inspection of the vessel after the date of expiration. Approved desalting kits capable of producing an equal amount of drinking water may be substituted for not more than one-third of the drinking water required to be carried in the lifeboat.

(2) The drinking water containers shall be stowed in drinking water tanks, lockers, or other compartments providing suitable protection.

(mm) *Whistle, signaling.* The whistle shall be of the ball-type, of corrosion-resistant construction, with a 3-foot lanyard attached, and in good working order.

(nn) *Fishing kit.* The fishing kit shall be of approved type constructed in accordance with Subpart 160.061 of Subchapter Q (Specifications) of this chapter.

(oo) *Cover, protecting.* The protecting cover shall be of a highly visible color, and capable of protecting the occupants against injury by exposure.

(pp) *Table of lifesaving signals.* The table shall be in accordance with the provisions of Chapter V, Regulation 16, of the International Convention for Safety of Life at Sea, 1960, and shall be printed on water resistant paper.

(qq) *Desalting kit.* One or more approved desalting kits may be used as a substitute for one-third of the required amount of drinking water per person, and shall be in accordance with Subpart 160.058 of Subchapter Q (Specifications) of this chapter.

**§ 75.20–20 Required equipment for liferafts.**

(a) The liferafts for all vessels shall be equipped in accordance with Table 75.20–20(a). For a description of the items contained in this table and the units comprising the items, see the applicable paragraphs of § 75.20–25. The letter identification prefixing the item in the table corresponds to the paragraph designation in § 75.20–25.

TABLE 75.20-20(a)

| Letter identification | Item | Ocean and coastwise | Great Lakes | Lakes, bays, sounds, and rivers |
|---|---|---|---|---|
| a | Boathook | 1 | 1 | 1 |
| b | Drinking cups | 1 | None | None |
| c | Jackknife | 1 | None | None |
| d | Lifeline | [1] 1 | [1] 1 | [1] 1 |
| e | Matches (boxes) | 1 | 1 | None |
| f | Mirrors, signaling | 2 | None | None |
| g | Oars | [2] 1 unit | [2] 1 unit | [2] 1 unit |
| h | Oil, storm (gallons) | 1 | 1 | None |
| i | Painter | 1 | 1 | 1 |
| j | Provisions (pounds per person) | 2 | None | None |
| k | Rowlocks | [2] 1 unit | [2] 1 unit | [2] 1 unit |
| l | Sea anchor | 1 | 1 | None |
| m | Signals, distress | [2] 1 unit | [2] 1 unit | None |
| n | Water (quarts per person) | 1 | None | None |
| o | Water light | 1 | 1 | None |

[1] Not required on Type A liferafts.
[2] For description of units see § 75.20-25.
[3] 1 unit here means 6 hand red flare distress signals and 6 parachute red flare distress signals with an approved means of projecting them.

(b) Inflatable liferafts shall be equipped with ocean service equipment for vessels on ocean and coastwise routes and with limited service equipment for vessels on Great Lakes, lakes, bays, sounds, and river routes in accordance with Subpart 160.051 of Subchapter Q (Specifications) of this chapter.

NOTE: Subpart 160.051 of Subchapter Q (Specifications) of this chapter requires the servicing of inflatable liferafts at approved servicing facilities. Included in the servicing at an approved servicing facility is a complete inspection of the required equipment by a marine inspector.

### § 75.20-25 Description of equipment for liferafts.

(a) *Boathook.* Boathooks shall be of the single hook ball point type. Boathook handles shall be of clear grained white ash, or equivalent, not less than 8 feet long and 1½ inches in diameter.

(b) *Drinking cups.* Drinking cups shall be enameled and shall be provided with ⅛ inch cotton lanyard, 3 feet in length.

(c) *Jackknife.* The jackknife (with can opener) shall be of an approved type, constructed in accordance with Subpart 160.043 of Subchapter Q (Specifications) of this chapter.

(d) *Lifeline.* The lifeline shall be properly secured around the sides and ends of the liferaft, festooned in bights not longer than 3 feet, with a seine float in each bight, which float may be omitted if the line is of an inherently buoyant material and aborbs little or no water. The lifeline shall be of a size and strength not less than ⅜-inch diameter manila.

(e) *Matches.* A box of friction matches in a watertight container.

(f) *Mirrors, signaling.* Signaling mirrors shall be of an approved type.

(g) *Oars.* A unit, consisting of 4 rowing oars and one steering oar not less than 8 feet in length shall be provided for liferafts for 7 persons or more. For liferafts for 6 persons or less, a unit shall consist of 2 paddles not less than 5 feet in length.

(h) *Oil, storm.* One gallon of vegetable, fish, or animal oil shall be provided in a suitable metal container so constructed as to permit a controlled distribution of oil on the water, and so arranged that it can be attached to the sea anchor.

(i) *Painter.* Painters shall be of manila rope not less than 2¾ inches in circumference and of a length not less than 3 times the distance between the deck on which the liferafts are stowed and the light draft of the vessel.

(j) *Provisions.* Two pounds of hard bread or its approved equivalent shall be provided for each person the liferaft is certified to carry. The provisions shall be packaged in hermetically sealed cans of an approved type. The cans shall be stowed in compartments providing suitable protection.

(k) *Rowlocks.* A unit consisting of 5 rowlocks attached to the liferaft by separate chains and ready for immediate use, together with proper rowlock sockets so arranged as to provide 4 rowing positions and one steering position with the liferaft floating either side up. Rowlocks and rowlock sockets are not required on liferafts for 6 persons or less.

(l) *Sea anchor.* The sea anchor shall be constructed of good quality canvas or other satisfactory material, and shall be not less than 2 feet in diameter.

(m) *Signals, distress.* A unit, consisting of equipment as specified in subparagraphs (1) to (3) of this paragraph. The service use of this equipment shall be limited to three years from date of manufacture, and replacement shall be made no later than the first annual inspection of the vessel after the date of expiration.

(1) Twelve approved hand red flare distress signals in a watertight container and two approved floating orange smoke distress signals, constructed in accordance with Subparts 160.021 and 160.022 of Subchapter Q (Specifications) of this chapter; or

(2) Twelve approved hand red flare distress signals in a watertight container and 12 approved hand orange smoke distress signals, constructed in accordance with Subparts 160.021 and 160.037 of Subchapter Q (Specifications) of this chapter; or

(3) Twelve approved hand combination flare and smoke distress signals, constructed in accordance with Subpart 160.023 of Subchapter Q (Specifications) of this chapter.

(n) *Water.* (1) For each person the liferaft is certified to carry, there shall be provided one quart of drinking water consisting of 3 approved hermetically sealed containers per person constructed and filled in accordance with Subpart 160.026 of Subchapter Q (Specifications) of this chapter. The service life of this equipment shall be limited to five years from date of packing, and replacement of outdated containers shall be made at the first annual inspection of the vessel after the date of expiration.

(2) The drinking water containers shall be stowed in compartments providing suitable protection.

(o) *Water light.* The water light shall be of an approved type, constructed in accordance with Subparts 160.012 or 161.001 of Subchapter Q (Specifications) of this chapter. The water light shall be attached to the liferaft by a 12-thread manila lanyard 3 fathoms in length.

### § 75.20-30 Required equipment for lifefloats and buoyant apparatus.

(a) The lifefloats and buoyant apparatus for all vessels shall be equipped in accordance with Table 75.20-30(a). For a description of the items contained in this table, and the units comprising the items, see the applicable paragraphs of § 75.20-35. The letter identification prefixing the item in the table corresponds to the paragraph designation in § 75.20-35.

TABLE 75.20-30(a)

| Letter identification | Item | Number required for each lifefloat and buoyant apparatus | | |
|---|---|---|---|---|
| | | Ocean and coastwise | Great Lakes | Lakes, bays, sounds, and rivers |
| a | Boathook [1] | 1 | 1 | 1 |
| b | Lifeline | 1 | 1 | 1 |
| c | Paddles [1] | 4 | 4 | 4 |
| d | Painter | 1 | 1 | 1 |
| e | Water light [2] | 1 | 1 | None |

[1] Buoyant apparatus need not be equipped with boathook or paddles.
[2] Equipment for 24 persons or less not required to have a water light.

### § 75.20-35 Description of equipment for lifefloats and buoyant apparatus.

(a) *Boathook.* Boathooks shall be of the single hook ball point type. Boathook handles shall be of clear grained white ash, or equivalent, not less than 6 feet long and 1½ inches in diameter.

(b) *Lifeline.* The lifeline shall be properly secured around the sides and ends of the lifefloat or buoyant apparatus, festooned in bights not longer than 3 feet, with a seine float in each bight, which float may be omitted if the line is of an inherently buoyant material and absorbs little or no water. The lifeline shall be of a size and strength not less than ⅜-inch diameter manila.

(c) *Paddles.* Paddles shall be not less than 5 feet long.

(d) *Painter.* (1) The painter for buoyant apparatus shall be of manila rope not less than 2 inches in circumference and of a length not less than 6 feet plus the distance between the deck

on which the buoyant apparatus is stowed and the light draft of the vessel.

(2) The painter for lifefloats shall be of manila rope not less than 2¾ inches in circumference and of a length not less than 3 times the distance between the deck on which the lifefloats are stowed and the light draft of the vessel.

(e) *Water light.* The water light shall be of an approved type, constructed in accordance with Subparts 160.012 or 161.001 of Subchapter Q (Specifications) of this chapter. The water light shall be attached to the lifefloat or buoyant apparatus by a 12-thread manila lanyard 3 fathoms in length.

**§ 75.20–90 Vessels contracted for prior to May 26, 1965.**

(a) Vessels contracted for prior to May 26, 1965, shall meet the following requirements:

(1) Except as specifically modified by this paragraph, the requirements of §§75.20–5 through 75.20–35 shall be complied with insofar as the number of items of equipment and the method of stowage of the equipment is concerned. Existing items of equipment previously approved, but not meeting the applicable specifications or requirements set forth in §§ 75.20–5 through 75.20–35 may be continued in service so long as they are maintained in a good condition to the satisfaction of the Officer in Charge, Marine Inspection. All new installations or replacements shall meet the applicable specifications or requirements in this part.

(2) Lifeboats previously approved without automatic drain plugs shall have two plugs or caps attached to the lifeboat by separate chains.

(3) Decked lifeboats shall have no drain holes or plugs, but shall be equipped with two bilge pumps.

(4) On vessels in ocean or coastwise service and contracted for prior to November 19, 1952, unless other approved means are provided to achieve the same purpose, three ½-inch diameter manila grablines shall be fitted extending from gunwale to gunwale under the keel to enable persons to cling to and climb upon the upturned lifeboat. The ends of each grabline shall be securely attached to the side benches or other permanent part of the lifeboat and each grabline shall be made up with figure eight knots spaced approximately 18 inches apart in order to provide hand grips. Means shall be provided for taking up any slack in the grablines.

## Subpart 75.25—Davits for Lifeboats

**§ 75.25–1 Application.**

(a) The provisions of this subpart, with the exception of § 75.25–90, shall apply to all vessels contracted for on or after May 26, 1965. Vessels contracted for prior to May 26, 1965, shall meet the requirements of § 75.25–90.

**§ 75.25–5 General.**

(a) All gravity and mechanical type davits shall be of an approved type, constructed in accordance with Subpart 160.032 of Subchapter Q (Specifications) of this chapter.

(b) Davits for lifeboats weighing in excess of 5,000 pounds when fully equipped (but without persons), shall be of the gravity type.

(c) All davits shall be so arranged that the lifeboats do not require lifting prior to being swung out.

(d) All davits and necessary gear shall be such as to meet the requirements for the installation test set forth in Subpart 75.35. The design, arrangements, and installation shall be such as to preclude undue delay in getting the lifeboats into the water, and shall be of such strength that the lifeboats can be turned out manned by a launching crew and then safely lowered with the full complement of persons and equipment, with the ship listed to 15 degrees either way and with a 10-degree trim.

(e) Radial davits, where permitted, shall comply with the following requirements:

(1) They shall be fitted with means to prevent them from being jerked from their sockets.

(2) They shall maintain a factor of safety of six based on the weight of the fully equipped and loaded lifeboat, except that the weight of the fully equipped lifeboat alone may be used where the lifeboat is launched before being loaded with passengers and crew.

(3) They shall be fitted with hand gear of sufficient power to insure that the boat can be turned out against a maximum list of 15 degrees.

(4) They shall be shop tested and show no permanent set or undue stress when subjected to a load equal to 2.2 times the working load. In addition, they shall be shop tested with a load equal to 1.1 times the weight of the fully equipped lifeboat with the davit set up to simulate a 15-degree list inboard, and it shall be determined that the hand gear can adequately handle the load in this condition.

(f) Davits shall be so disposed on one or more decks as to permit the lifeboats placed under them to be safely lowered without interference from the operation of any other davits.

(g) On a vessel on which inflatable life rafts have been substituted for lifeboats, a launching device for each lifeboat to be used for rescue purposes shall be installed. Radial type davits or other means may be used in sheltered waters if acceptable to the Officer in Charge, Marine Inspection.

**§ 75.25–10 Requirements for vessels in ocean or coastwise service.**

(a) All vessels shall be fitted with a set of approved gravity or mechanical davits for each lifeboat carried.

(b) All davit installations shall have two lifelines fitted to a davit span: *Provided*, That the span fitted to the davits which are used to handle the emergency lifeboats required by § 75.10–10(a)(3) shall have four such lifelines. The lifelines shall be of such length as to reach the water at the lightest seagoing draft with the vessel listed 15 degrees either way.

**§ 75.25–15 Requirements for vessels in Great Lakes; lakes, bays, and sounds; or river service.**

(a) All vessels shall be fitted with a set of approved gravity or mechanical davits for each lifeboat carried, except that on small vessels, radial type davits may be used if specifically approved by the Commandant.

(b) Davit installations on vessels in Great Lakes service shall have at least 2 lifelines fitted to a davit span. The lifelines shall be of such length as to reach the water at the lightest seagoing draft with the vessel listed 15 degrees either way.

**§ 75.25–90 Vessels contracted for prior to May 26, 1965.**

(a) Vessels contracted for prior to May 26, 1965, shall meet the following requirements:

(1) Except as specifically modified by this paragraph, the requirements of §§ 75.25–5 through 75.25–15 shall be complied with insofar as the number and general type of equipment is concerned. Existing items of equipment previously approved, but not meeting the applicable specifications or requirements set forth in §§ 75.25–5 through 75.25–15 may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs, alterations, and replacements may be made to the same standards as the original installation. However, all new installations or major replacements shall meet the applicable specifications or requirements in this subpart.

(2) On vessels the keels of which were laid after September 1, 1941, all davits for lifeboats weighing in excess of 5,000 pounds when fully equipped (but without persons) shall be of the gravity type.

(3) Existing vessels having nested lifeboats may continue such arrangements.

## Subpart 75.27—Inflatable Liferaft Launching Devices

**§ 75.27–1 Application.**

(a) The provisions of this subpart shall apply to all vessels on an international voyage on which liferafts were permitted to be substituted for lifeboats under the provisions of § 75.10–10(a)(5).

**§ 75.27–5 General.**

(a) All launching devices for putting liferafts loaded with persons in the water shall be of an approved type.

(b) The design, arrangement, and installation of all launching devices shall be such as to preclude any undue delay in getting the liferafts safely into the water loaded with their full complement of persons and equipment even with unfavorable conditions of trim and a list of 15 degrees either way. The design shall provide a factor of safety of at least 6 in these conditions, based upon the ultimate strength of the materials.

(c) Launching devices shall be so arranged that after the rafts are loaded with persons, they do not require lifting prior to being swung out or lowered.

(d) Launching devices shall be provided with suitable means for detaching the liferafts from the falls which is operable from inside the liferaft, or by an automatic release which shall operate when the weight of the loaded raft is waterborne; however, such an automatic release shall be limited to rafts which are suspended from a single attachment point.

(e) Launching devices shall be provided with means for rapidly retrieving the falls by hand power.

(f) The number of approved liferaft launching devices required to be provided and the number of liferafts allocated to each launching device shall be as determined by the Commandant, and shall be such that fully loaded liferafts and lifeboats of sufficient capacity to accommodate all persons on board can be put into the water in not more than 30 minutes in calm conditions.

(g) On vessels where approved liferaft launching devices are required, they shall be distributed equally on each side of the vessel, and in no case shall there be less than two launching devices, one on each side.

## Subpart 75.30—Lifeboat Winches

### § 75.30–1 Application.

(a) The provisions of this subpart, with the exception of § 75.30–90, shall apply to all vessels contracted for on or after May 26, 1965. Vessels contracted for prior to May 26, 1965, shall meet the requirements of § 75.30–90.

### § 75.30–5 General.

(a) All lifeboat winches shall be of an approved type, constructed in accordance with Subpart 160.015 of Subchapter Q (Specifications) of this chapter.

(b) Where ice conditions are likely to be encountered, suitable fabric covers shall be provided for all lifeboat winches, so fitted over exposed mechanism, that ice formations may be readily broken adrift when necessary to operate the winch.

(c) Where lifeboat winches are used, wire falls shall be employed.

### § 75.30–10 Number and type required.

(a) Lifeboat winches shall be fitted for each set of davits on all vessels where the height of the deck on which lifeboats are carried exceeds 20 feet from the lightest seagoing draft.

(b) Lifeboat winches shall be used in all cases where gravity type davits are employed.

(c) Lifeboat winches for use with gravity davits shall have grooved drums of such size that there will be only one layer of wire on the drums. Lifeboat winches for use with mechanical davits need not have grooved drums, and may be designed to take more than one layer of wire.

(d) Lifeboat winches shall be fitted for each set of davits used for the emergency lifeboats, and in addition to meeting all other requirements for winches, the emergency lifeboat winch shall be capable of recovering the emergency lifeboat with its full complement of persons and equipment at a hoisting speed of not less than 20 feet per minute.

### § 75.30–15 Installation.

(a) Lifeboat winches shall be so located that the operator can observe the movement of the lifeboat during the lowering operation. In addition, any electrical controls provided shall meet the requirements of § 111.65–40 of Subchapter J (Electrical Engineering) of this chapter.

(b) The lead of the falls to the lifeboat winches and length and size of wire shall be in accordance with Subpart 75.33.

### § 75.30–90 Vessels contracted for prior to May 26, 1965.

(a) Vessels contracted for prior to May 26, 1965, shall meet the following requirements:

(1) Except as specially modified by this paragraph, the requirements of §§ 75.30–5 through 75.30–15 shall be complied with insofar as the number and general type of equipment is concerned. Existing items of equipment previously approved, but not meeting the applicable specifications or requirements set forth in §§ 75.30–5 through 75.30–15 may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. However, all new installations or major replacements shall meet the applicable specifications or requirements in this part.

(2) Vessels certificated for river service need not comply with the requirements of § 75.30–10(a).

(3) Existing arrangements previously approved, but not meeting the requirements of § 75.30–10(d) or § 75.30–15(a), need not be changed. However, new installations or major alterations should conform with such requirements where reasonable and practicable.

(4) Where lifeboat winches are used with gravity davits, the installation shall comply with the requirements contained in § 160.015–3(k), of Subpart 160.015 (Lifeboat Winches) of Subchapter Q (Specifications) of this chapter.

(5) Lifeboat winches for use with nested lifeboats shall be provided with suitable means for rapidly retrieving the falls by handpower unless separate falls are provided for each lifeboat.

## Subpart 75.33—Blocks and Falls for Lifeboats

### § 75.33–1 Application.

(a) The provisions of this subpart, with the exception of § 75.33–90, shall apply to all vessels contracted for on or after May 26, 1965. Vessels contracted for prior to May 26, 1965, shall meet the requirements of § 75.33–90.

### § 75.33–5 General.

(a) All blocks, falls, fairleads, padeyes, shackles, links, fastenings, etc., used in connection with lifeboat gear shall be designed with a minimum factor of safety of six, based on the maximum working load.

(b) Falls shall be of such length that the lifeboat may be lowered to the water with the vessel at its lightest draft listed 15 degrees either way.

(c) Falls, where exposed and subject to damage or fouling, shall be suitably protected.

(d) Such blocks or other fittings shall be fitted as are necessary to permit the falls to lead fair in all positions to the davits.

(e) Means for lubrication shall be provided for all moving parts of blocks, sheaves, fairleads, etc.

### § 75.33–10 Installations where lifeboat winches are used.

(a) All falls shall be of wire rope.

(b) Wire rope falls of 6 x 19 regular lay filler wire construction, prelubricated at the factory with suitable neutral wire rope lubricant, shall be accepted as standard. Any other wire rope, superior or equal to this minimum standard may be used.

(c) Not more than 2-part falls may be used, except in special cases where 3-part falls may be permitted by the Commandant.

(d) The lead sheaves to the drum shall be located so as to provide fleet angles of not more than 8 degrees for grooved drums and not more than 4 degrees for nongrooved drums. By fleet angle is meant the angle included between the wire rope from the lead sheave to the drum (or drum extended) when it is perpendicular to the axis of the drum, and the wire rope from the lead sheave to either extremity of the drum.

(e) Sheaves shall have a diameter at the base of the groove at least equal to 12 times the diameter of the wire rope.

### § 75.33–15 Installations where lifeboat winches are not used.

(a) All falls shall be of manila rope or equivalent. Wire rope may not be used.

(b) All vessels of over 1,000 gross tons shall be provided with covered tubs, boxes, or reels for the stowage and protection of the falls, and cruciform bitts shall be provided for properly lowering the lifeboats. Vessels of 1,000 gross tons and less shall have the falls protected from ice and ready for immediate use, and shall be provided with suitable lowering bitts or cleats.

(c) There shall be ample clearance between the cheeks of all blocks. The width between the cheeks shall be one-half inch greater than the diameter of new rope when rope of 3¾-inch circumference or greater is used. Blocks for smaller rope shall be designed with proportional clearances.

### § 75.33–90 Vessels contracted for prior to May 26, 1965.

(a) Vessels contracted for prior to May 26, 1965, shall meet the following requirements:

(1) Except as specifically modified by this paragraph, the requirements of §§ 75.33–5 through 75.33–15, as applicable, shall be complied with insofar as the general type of equipment is concerned. Existing equipment previously approved, but not meeting the detailed requirements of §§ 75.33–5 through 75.33–15 may be continued in service so long as they

are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs, alterations, and replacements may be made to the same standards as the original installation. However, all new installations or major replacements shall meet the applicable requirements in this subpart.

(2) When nested lifeboats are used, the lower blocks shall be of the nontoppling type unless separate falls are provided for each lifeboat. Separate falls shall be provided for each lifeboat in all nested lifeboat installations not using wire falls.

## Subpart 75.35—Installation of Lifeboats, Davits, and Winches

### § 75.35–1 Application.

(a) The provisions of this subpart shall apply to all installations contracted for on or after November 19, 1952, except as set forth in § 78.17–60 (c) of this subchapter.

### § 75.35–5 Tests and examinations.

(a) Upon completion of the installation of lifeboats, davits, or winches, tests and examinations as required by this section shall be made to the satisfaction of the inspector before the vessel may be navigated.

(b) The lifeboat shall be swung out from the chocks and lowered to the embarkation deck. At this point the lifeboat shall be loaded with deadweight equivalent to the number of persons allowed (165 pounds per person) together with weight of equipment, plus 10 percent of the total load including the weight of the lifeboat. No persons shall be permitted in the lifeboat while it is being loaded or lowered. The lifeboat shall then be lowered to the water and disengaged from the falls. If nested lifeboats are installed, both lifeboats shall be launched in the manner noted above. The following determinations shall be made:

(1) None of the equipment or parts thereof nor deck connections shall show signs of permanent set or excessive deflection.

(2) Mechanical and radial type davits shall be capable of being swung out without lifting the lifeboat.

(3) The falls shall be of sufficient length to lower the lifeboat as required by § 75.33–5(b).

(4) Where lifeboat winches are used, the following additional determinations shall be made:

(i) During lowering, the lifeboat shall be stopped at intervals of approximately 6 feet by the action of the counterweight alone. The counterweight shall be capable of stopping and holding the lifeboat. The brake action shall be smooth, but positive.

(ii) Brakes exposed to the weather shall be tested under the load conditions with the braking surfaces both wet and dry.

(iii) The governor brake shall be capable of controlling the speed of lowering of the fully equipped lifeboat with its complement of persons on board to not more than 120 feet per minute. In addition, the speed of lowering of the fully equipped lifeboat without its complement of persons shall be not less than 40 feet per minute. However, emergency lifeboats shall have a minimum lowering speed of 60 feet per minute in the fully equipped condition without persons aboard and a maximum lowering speed of 160 feet per minute in the fully equipped condition with the full complement of persons aboard.

(iv) Emergency lifeboat winches required to meet the provisions of § 75.30–10(d) shall be capable of recovering the emergency lifeboats in the fully equipped condition with the full complement of persons aboard at a hoisting speed of not less than 20 feet per minute.

(v) If nesting lifeboats are used, the hand-operated quick-return mechanism shall be tested. The action shall be easy enough for one man to recover the falls.

## Subpart 75.37—Installation of Inflatable Liferaft Launching Devices

### § 75.37–1 Application.

(a) The provisions of this subpart shall be applicable to all installations contracted for on or after May 26, 1965, except as specifically noted.

### § 75.37–5 Tests and examinations.

(a) Upon completion of the installation of liferaft launching devices, tests and examinations as required by this section shall be made to the satisfaction of the marine inspector before the vessel may be navigated.

(b) A fully equipped liferaft shall be inflated at its embarkation position. It shall then be loaded with deadweight equivalent to the number of persons allowed (165 pounds per person), plus 10 percent of the total load, which shall include the weight of the fully equipped raft. The liferaft shall then be lowered to the water and disengaged from the falls. Necessary safety precautions shall be taken for persons engaged in the loading of the liferaft. No person shall be allowed in the liferaft while it is being lowered. The following determinations shall be made:

(1) None of the equipment or parts thereof nor deck connections shall show signs of permanent set or excessive deflection.

(2) Arrangements at the embarkation deck shall be such that persons may be rapidly and safely loaded into the liferaft.

(3) The fully loaded liferaft shall be capable of being swung out from the embarkation deck and lowered without lifting.

(4) The falls shall be of sufficient length to lower the liferaft to the light load line with the vessel heeled 15 degrees inboard and with a 10-degree trim.

(5) During lowering, the liferaft shall be stopped at intervals of approximately 6 feet by the action of the counterweight alone. The counterweight shall be capable of stopping and holding the liferaft. The brake action shall be smooth, but positive.

(6) Brakes exposed to the weather shall be tested under the load conditions with the braking surfaces both wet and dry.

(7) The governor brake shall be capable of controlling the speed of lowering the fully equipped liferaft with its complement of persons on board to not more than 120 feet per minute. In addition, the speed of lowering of the fully equipped liferaft without its complement of persons shall be not less than 40 feet per minute.

(8) The hand-operated quick-return mechanism shall be tested. The action shall be easy enough for one man to recover the falls.

(c) Other methods of testing liferaft launching devices to demonstrate compliance with paragraph (b) of this section, which do not involve the launching of a fully loaded raft may be authorized, if in the opinion of the Commandant, such alternate tests adequately demonstrate compliance with the requirements.

## Subpart 75.40—Life Preservers

### § 75.40–1 Application.

(a) The provisions of this subpart, with the exception of § 75.40–90, shall apply to all vessels contracted for on or after May 26, 1965.

(b) Vessels contracted for prior to May 26, 1965, shall meet the requirements of § 75.40–90.

### § 75.40–5 General.

(a) All life preservers shall be of an approved type, constructed in accordance with Subparts 160.002, 160.005, or 160.055 of Subchapter Q (Specifications) of this chapter.

(b) All life preservers on vessels on an international voyage shall be provided with a whistle of the ball-type, of corrosion-resistant construction, with a 3-foot lanyard attached, and in good working order. It shall be attached to the life preserver by the lanyard alone without hooks, snaps, clips, etc., and shall extend not less than 15 inches from the life preserver body. While stowed on the life preserver, the whistle lanyard shall be coiled and stopped-off.

### § 75.40–10 Number and type required.

(a) All vessels shall be provided with an approved type life preserver for each person carried and in addition, shall be provided with a number of life preservers suitable for children equal to at least 10 percent of the persons carried.

(b) In addition to the life preservers required by paragraph (a) of this section, all vessels on an international voyage shall be provided with approved type life preservers for 5 percent of the persons carried.

### § 75.40–15 Distribution.

(a) Life preservers, including those especially provided for children, shall be properly distributed throughout the staterooms, berthings, and other places convenient for passengers and crew.

(b) The additional life preservers required by § 75.40–10(b) shall be stowed in conspicuous places on deck.

**§ 75.40–20 Stowage.**

(a) Lockers, boxes, and closets in which life preservers are stowed shall not be capable of being locked, shall be plainly marked, and the life preservers contained therein shall be readily available.

(b) Life preservers stowed overhead shall be so supported that they can be quickly released and distributed among the passengers. Where life preservers are stowed at a height greater than 7 feet from the deck below, efficient means shall be provided for their immediate release and distribution to be operated by persons standing on the deck.

**§ 75.40–25 Notices.**

(a) A printed notice, as described in §§ 78.47–47 and 78.47–50 of this subchapter, shall be posted in every passenger cabin and stateroom and in conspicuous places about the decks, informing passengers of the location of life preservers and describing and illustrating the method of donning and adjusting them.

**§ 75.40–90 Vessels contracted for prior to May 26, 1965.**

(a) Vessels contracted for prior to May 26, 1965, shall meet the following requirements:

(1) Except as specifically modified by this paragraph, the requirements of §§ 75.40–5 through 75.40–25 shall be complied with insofar as the number of items of equipment and the method of stowage and notice is concerned. Existing items of equipment previously approved, but not meeting the applicable specifications or requirements set forth in §§ 75.40–5 through 75.40–25 may be continued in service so long as they are serviceable and in good condition to the satisfaction of the Officer in Charge, Marine Inspection, except that:

(i) All kapok and fibrous glass life preservers which do not have plastic-covered pad inserts, as required by Subparts 160.002 and 160.005 of Subchapter Q (Specifications) of this chapter, shall be removed from service.

(2) Where prior to November 19, 1952, wood floats were substituted for approved type adult life preservers, such wood floats may be continued in service so long as they are serviceable and in good condition to the satisfaction of the Officer in Charge, Marine Inspection, on steam vessels in river service, barges carrying passengers while in tow of a steam vessel in other than ocean or coastwise service, and river ferryboats propelled by steam. Where permitted, wood floats shall be stowed in the most accessible spaces.

(3) All new installations or replacements shall meet the applicable specifications or requirements, except that:

(i) Cork and balsa wood life preservers, constructed in accordance with the applicable provisions of Subpart 160.003 or 160.004 and manufactured as approved life preservers prior to July 1, 1965, may be accepted as new or replacement equipment required by this subchapter if such life preservers are serviceable and in good condition to the satisfaction of the Officer in Charge, Marine Inspection: *Provided, however,* That such life preservers bearing basic Approval No. 160.003 or 160.004 shall not be considered as approved equipment meeting the requirements for those passenger ships on an international voyage, constructed or contracted for on or after May 26, 1965.

## Subpart 75.43—Ring Life Buoys and Water Lights

**§ 75.43–1 Application.**

(a) The provisions of this subpart, with the exception of § 75.43–90, shall apply to all vessels contracted for on or after May 26, 1965. Vessels contracted for prior to May 26, 1965, shall meet the requirements of § 75.43–90.

**§ 75.43–5 General.**

(a) All ring life buoys shall be of an approved type, constructed in accordance with Subpart 160.009 or 160.050 of Subchapter Q (Specifications) of this chapter.

(b) All water lights shall be of an approved type, constructed in accordance with Subparts 160.012 or 161.001 of Subchapter Q (Specifications) of this chapter.

(c) All self-activating smoke signals shall be of an approved type, constructed in accordance with the requirements of Subpart 160.057 of Subchapter Q (Specifications) of this chapter which shall be capable of producing smoke of a highly visible color for at least 15 minutes.

**§ 75.43–10 Number required.**

(a) The minimum number of approved 30-inch ring life buoys, and the minimum number of which shall have water lights attached, shall be in accordance with Table 75.43–10 (a).

TABLE 75.43–10 (a)

| Length of vessel in feet | Ocean | | All services other than ocean | |
|---|---|---|---|---|
| | Minimum number of ring life buoys | Minimum number of ring life buoys in column 2 which shall have water lights attached | Minimum number of ring life buoys | Minimum number of ring life buoys in column 4 which shall have water lights attached |
| Column 1 | Column 2 | Column 3 | Column 4 | Column 5 |
| Under 100 | 8 | 8 | 2 | 0 |
| 100 and under 200 | 8 | 6 | 4 | 2 |
| 200 and under 300 | 8 | 6 | 6 | 2 |
| 300 and under 400 | 12 | 6 | 12 | 4 |
| 400 and under 600 | 18 | 9 | 16 | 9 |
| 600 and under 800 | 24 | 12 | 24 | 12 |
| 800 and over | 30 | 14 | 30 | 15 |

(b) One of the ring life buoys on each side of the vessel shall have secured to it a line at least 15 fathoms in length. On vessels on an international voyage, the line shall be of a buoyant type.

(c) On vessels on an international voyage, at least two of the ring life buoys with water lights attached as required by Table 75.43–10(a) shall also be provided with an approved self-activated smoke signal and shall be capable of quick release from the navigating bridge.

(d) On vessels on an international voyage, the ring life buoys required by this section shall be orange in color.

**§ 75.43–15 Distribution and securing.**

(a) All ring life buoys shall be placed so as to be readily accessible to the persons on board, and their positions plainly indicated so as to be known to the persons concerned.

(b) The ring life buoys shall always be capable of being cast loose, and shall not be permanently secured in any way.

**§ 75.43–90 Vessels contracted for prior to May 26, 1965.**

(a) Vessels contracted for prior to May 26, 1965, shall meet the following requirements:

(1) Except as specifically modified by this paragraph, the requirements of §§ 75.43–5 through 75.43–15 shall be complied with insofar as the number of items of equipment and the method of stowage is concerned. Existing items of equipment previously approved, but not meeting the applicable specifications or requirements set forth in §§ 75.43–5 through 75.43–15 may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. All new installations or replacements shall meet the applicable specifications or requirements in this subpart.

## Subpart 75.45—Line-Throwing Appliances

**§ 75.45–1 Application.**

(a) The provisions of this subpart, with the exception of § 75.45–90, shall apply to all vessels on an international voyage and all other vessels of 150 gross tons and over certificated for ocean or coastwise service, contracted for on or after November 19, 1952. Such vessels contracted for prior to November 19, 1952, shall meet the requirements of § 75.45–90.

**§ 75.45–5 General.**

(a) Line-throwing appliances of the impulse-projected rocket type, and the equipment auxiliary thereto, shall be of

an approved type, constructed in accordance with Subpart 160.040 of Subchapter Q (Specifications) of this chapter. The service use of rockets shall be limited to four years from date of manufacture, and replacement shall be made no later than the first annual inspection of the vessel after the date of expiration.

(b) Line-throwing appliances of the shoulder gun type, and the equipment auxiliary thereto, shall be of an approved type, constructed in accordance with Subpart 160.031 of Subchapter Q (Specifications) of this chapter.

**§ 75.45–10 Type required.**

(a) All vessels shall be fitted with an approved line-throwing appliance of the impulse-projected rocket type. However, vessels of less than 500 gross tons and not on an international voyage may substitute a line-throwing appliance of the shoulder gun type.

**§ 75.45–15 Equipment for line-throwing appliances.**

(a) The equipment enumerated in this paragraph shall be carried for impulse-projected rocket type line-throwing appliances. Except as noted, the equipment and the appliance shall be stowed together in a suitable case or box:

(1) Four rockets, two of which shall be of the buoyant type.

(2) Four primer-ejector cartridges.

(3) Four service lines, each of a length not less than that specified in the approval of the appliance carried, of 7/32-inch to 9/32-inch diameter, of flax or manila, and having a breaking strength of at least 500 pounds, to be kept in faking boxes or on reels. These lines may be kept either in the box or case with the remainder of the equipment, or be stowed in an accessible location nearby.

(4) One cleaning brush, one can of oil, and twelve wiping patches.

(5) One set of instructions furnished by the manufacturer.

(6) One auxiliary line 1,500 feet of 3-inch circumference manila. This line may be kept either in the box or case with the remainder of the equipment or be stowed in an accessible location nearby.

(b) The equipment enumerated in this paragraph shall be carried for shoulder gun type line-throwing appliances. Except as noted, the equipment and the appliance shall be stowed together in a suitable case or box.

(1) Ten service projectiles.

(2) Twenty-five cartridges.

(3) Four service lines, each not less than 400 feet in length, of 3/8-inch circumference flax or cotton and having a breaking strength of at least 250 pounds, or each not less than 600 feet in length of 1/16-inch or more diameter woven or braided nylon, very flexible, having a breaking strength not less than 140 pounds, or equivalent, to be kept in faking boxes or on reels. These lines may be kept either in the box or case with the remainder of the equipment or be stowed in an accessible location nearby.

(4) One cleaning rod with brush, one can of oil, and twelve wiping patches.

(5) One set of instructions furnished by the manufacturer.

(6) One auxiliary line, 500 feet of 3-inch circumference manila.

**§ 75.45–20 Accessibility.**

(a) The line-throwing appliance and its equipment shall be kept easily and readily accessible and ready for use. No part of this equipment shall be used for any other purpose.

**§ 75.45–25 Service recommendations.**

(a) In firing the line-throwing appliances, the operating instructions and safety precautions furnished by the manufacturer should be followed.

**§ 75.45–90 Vessels contracted for prior to November 19, 1952.**

(a) Vessels of 150 gross tons and over in ocean or coastwise service, and vessels of any tonnage on an international voyage, contracted for prior to November 19, 1952, shall meet the requirements set forth in §§ 75.45–5 through 75.45–25. However, if a Lyle gun type line-throwing appliance is already in service on such vessel, it may be continued in use so long as it is in good and serviceable condition, but may not be replaced by a similar installation. Where Lyle guns are used, the following requirements shall be met:

(1) The equipment enumerated in this subparagraph shall be carried for Lyle gun type line-throwing appliances. The equipment and the gun shall be stowed together in a suitable case or box. If the case or box does not meet the requirements of Subpart 160.038 (Portable Magazine Chest) of Subchapter Q (Specifications) of this chapter, the powder shall be separately stowed in a chest meeting such requirements.

(i) Six service projectiles.

(ii) Eighteen bags (2½ ounces each) of black powder marked "One-half normal charge for Lyle gun, 2½ ounces black powder" in a nonferrous metal screw top container.

(iii) One approved firing attachment with accessories consisting of lanyard, wrench, washer to fit between barrel and shoulder of firing attachment, blank plug for screwing into gun when firing attachment is not in place, cartridge extractor, and 25 primers in a watertight metal box.

(iv) Twenty-five paper wads.

(v) Four service lines, each 1,700 feet in length, of 7/32-inch to 9/32-inch diameter flax or manila, and having a breaking strength of at least 500 pounds, to be kept in faking boxes or on reels.

(vi) One ramrod, 1 wire brush, 1 can of light petrolatum, and 12 wiping patches.

(vii) One tapered wooden plug for muzzle of gun when not in use.

(viii) One set of instructions furnished by the manufacturer of the gun.

(ix) One auxiliary line, 1,500 feet of 3-inch circumference manila.

(2) Accessibility requirements are the same as § 75.45–20.

## Subpart 75.50—Embarkation Aids

**§ 75.50–1 Application.**

(a) The provisions of this subpart, with the exception of § 75.50–90, shall apply to all vessels contracted for on or after May 26, 1965. Vessels contracted for prior to May 26, 1965, shall meet the requirements of § 75.50–90.

**§ 75.50–5 Ladders.**

(a) Vessels certificated for ocean, coastwise or Great Lakes service shall have ladders as follows:

(1) All ladders required by this paragraph shall be of approved types, constructed in accordance with Subpart 160.017 of Subchapter Q (Specifications) of this chapter.

(2) All vessels shall have an approved Type II (chain suspension) ladder for each set of lifeboat davits, but existing ladders previously approved by the Coast Guard may be continued in service so long as they are maintained in good and serviceable condition. Such ladders shall be kept ready and convenient for use on the lifeboat deck, and shall reach from such deck to the vessel's light water line, no heel assumed.

(3) All vessels certificated for ocean or coastwise service, which normally employ a pilot shall have a ladder for the use of the pilot, in addition to the ladders required by subparagraph (2) of this paragraph. Suitable spreaders, a man rope, and a safety line shall be kept readily available for use in conjunction with the pilot ladder whenever circumstances may so require. When used, the ladder shall be secured in a position so that each step rests firmly against the ship's side, and so the pilot can gain safe and convenient access to the ship after climbing not more than 30 feet. Whenever the distance from sea level is more than 30 feet, access from the pilot ladder to the ship shall be by means of an accommodation ladder or other equally safe and convenient means. Arrangements shall be such that the rigging of the ladder and the embarkation of the pilot is supervised by a responsible officer of the ship and handholds are provided to assist the pilot to pass safely and conveniently from the head of the ladder into the ship or onto the ship's deck. At night a light shining over the side shall be available for use, and the deck at the position where the pilot boards the ship shall be adequately lighted.

(b) Vessels certificated for lakes, bays, and sounds service shall be provided with a suitable ladder for each set of lifeboat davits. Such ladders shall be reversible and free from garment-entangling projections. They shall be kept ready and convenient for use on the lifeboat deck, and shall reach from such deck to the vessel's light water line, no heel assumed.

(c) Vessels certificated for river service shall be provided with suitable ladders to enable passengers to descend conveniently to the lifeboats.

**§ 75.50–7 Embarkation aids into inflatable liferafts.**

(a) Where inflatable liferafts are substituted for lifeboats, unless freeboard at embarkation point is such that embarkation devices are not necessary, suitable arrangements shall be made for embarkation which shall include sufficient ladders or other suitable devices to facilitate embarkation into the inflatable liferafts when waterborne.

**§ 75.50–10 Illumination for lifeboat launching operations.**

(a) Provisions shall be made on all vessels on international voyages, and all other vessels where the lifeboat deck is more than 30 feet above the light water line, for readily and continuously available illumination from the vessel of lifeboats when alongside and in process of or immediately after being launched. Details of the illuminating system shall be in accordance with Subchapter J (Electrical Engineering) of this chapter.

**§ 75.50–15 Illumination for inflatable liferaft launching operations.**

(a) On all vessels on an international voyage there shall be provided for any liferafts for which approved launching devices are carried, means for illuminating the liferafts and their launching gear during the preparation for and during the process of launching, and also for illuminating the water into which the liferafts are launched. In addition, there shall be provided means of illuminating the stowage position of liferafts for which approved launching devices are not carried. Details of the illuminating system shall be in accordance with applicable requirements in Subchapter J (Electrical Engineering) of this chapter.

**§ 75.50–90 Vessels contracted for prior to May 26, 1965.**

(a) Vessels contracted for prior to May 26, 1965, shall meet the following requirements:

(1) Except as specifically modified by this paragraph, the requirements of §§ 75.50–5 through 75.50–15 shall be complied with insofar as the number of items of equipment and the method of stowage is concerned. Existing items of equipment previously approved, but not meeting the applicable specifications or requirements of §§ 75.50–5 through 75.50–15 may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. All new installations or replacements shall meet the applicable specifications or requirements in this subpart.

## Subpart 75.55—Portable Radio Apparatus

**§ 75.55–1 Required on international voyage.**

(a) Any vessel on an international voyage shall be provided with a portable radio apparatus complying with the requirements of the Federal Communications Commission, unless at least one lifeboat on each side of the vessel is fitted with a fixed radio installation. The apparatus shall be so designed that it may be used by an unskilled person. Such apparatus shall be kept in the radioroom, chartroom, or other suitable location ready to be moved to one or other of the lifeboats in the event of an emergency. See also § 75.10–10(a)(4).

## Subpart 75.90—Ship's Distress Signals

**§ 75.90–1 Application.**

(a) The provisions of this subpart shall apply to all vessels, except as specifically noted.

**§ 75.90–5 Vessels in ocean or coastwise service.**

(a) All vessels in ocean service and all vessels in coastwise service shall carry within the pilothouse or on the navigator's bridge, 12 approved handheld rocket-propelled parachute red flare distress signals constructed in accordance with Subpart 160.036 of Subchapter Q (Specifications) of this chapter.

(b) All vessels under 100 gross tons in coastwise service may carry in lieu of signals required by paragraph (a) of this section within the pilothouse or in other locations considered suitable by the Officer in Charge, Marine Inspection, pyrotechnic signals as follows:

(1) Six hand red flare distress signals and 6 hand orange smoke distress signals; constructed in accordance with Subpart 160.021 and 160.037 of Subchapter Q (Specifications) of this chapter; or

(2) Twelve hand combination flare and smoke distress signals, constructed in accordance with Subpart 160.023 of Subchapter Q (Specifications) of this chapter.

(c) All pyrotechnic signals shall be stowed in a portable watertight container.

(d) The service use of the distress signals shall be limited to a period of 3 years from the date of manufacture, and replacement shall be made no later than the first annual inspection of the vessel after the date of expiration.

**§ 75.90–10 Vessels in Great Lakes service.**

(a) All vessels of 150 gross tons and over in Great Lakes service shall carry within the pilothouse or on the navigator's bridge, twelve approved handheld red flare distress signals contained in a portable watertight container, constructed in accordance with Subpart 160.021 or Subpart 160.023 of Subchapter Q (Specifications) of this chapter. The service use of the distress signals shall be limited to a period of three years from date of manufacture, and replacement shall be made no later than the first annual inspection of the vessel after the date of expiration.

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# PART 76—FIRE PROTECTION EQUIPMENT

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76.60–5 Number required.
76.60–10 Location.

AUTHORITY: The provisions of this Part 76 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4417, as amended, 4418, as amended, 4426, as amended, 4488, as amended, 4491, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 17, 54 Stat. 166, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 391, 392, 404, 481, 489, 395, 363, 367, 526p, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, 21 F.R. 4894; CGFR 56–28, July 24, 1956, 21 F.R. 5659; 167–38, Oct. 26, 1959, 24 F.R. 8857.

## Subpart 76.01—Application

### § 76.01–1 General.

(a) The provisions of this part shall apply to all vessels except as specifically noted in this part.

### § 76.01–5 Equipment installed but not required.

(a) Where fire detecting or extinguishing systems or equipment are not required, but are installed, the system or equipment and its installation shall meet the requirements of this part.

## Subpart 76.05—Fire Detecting and Extinguishing Equipment, Where Required

### § 76.05–1 Fire detecting systems.

(a) Approved fire detecting systems shall be installed in locations as required by Table 76.05–1(a) on the following vessels:

(1) Any vessel on an international voyage.

(2) Any vessel of more than 150 feet in length having sleeping accommodations for passengers.

(3) Any vessel of 150 feet or less in length, not on an international voyage, having sleeping accommodations for 50 or more passengers. Vessels in this category are not required to have a detecting system in the cargo spaces.

(b) The arrangement and details of the fire detecting systems shall be as set forth in Subparts 76.25 through 76.33.

### § 76.05–5 Manual alarm system.

(a) An approved manual alarm system shall be installed in all areas, other than the main machinery spaces, which are normally accessible to the passengers or crew on any vessel having sleeping accommodations for passengers or on any vessel on an international voyage.

(b) The arrangement and details of the manual alarm system shall be as set forth in Subpart 76.35.

### § 76.05–10 Supervised patrol system.

(a) A supervised patrol or watchman system shall be provided on all vessels as set forth in §§ 78.30–10 and 78.30–15 of this subchapter.

TABLE 76.05–1(a)

| Space | Detecting systems | Fixed extinguishing systems |
|---|---|---|
| *Safety areas* | | |
| Wheelhouse or fire-control room | None required [1] | None required.[1] |
| Stairway and elevator enclosures | do.[1] | Do.[1] |
| Communication corridors | do.[1] | Do.[1] |
| Lifeboat embarkation and lowering stations | do | Do. |
| Radio room | do.[1] | Do.[1] |
| *Accommodations* | | |
| Staterooms, toilet spaces, isolated pantries, etc. | do.[1] | Do.[1] |
| Offices, lockers, and isolated storerooms | Electric, pneumatic, or automatic sprinkling.[1] | Do.[1] |
| Public spaces | None required with 20-minute patrol. Electric, pneumatic, or automatic sprinkling with 1 hour patrol.[1] | Do.[1] |
| Open decks or enclosed promenades | None required | Do. |
| *Service spaces* | | |
| Galleys | do.[1] | Do.[1] |
| Main pantries | do.[1] | Do.[1] |
| Motion picture booths and film lockers | Electric, pneumatic, or automatic sprinkling.[1 2] | Do.[1 2] |
| Paint and lamp rooms | Smoke detecting [3] | Carbon dioxide.[4] |
| Inaccessible baggage, mail, and specie rooms and storerooms | do | Do. |
| Accessible baggage, mail, and specie rooms and storerooms. | Electric, pneumatic, or automatic sprinkling. | None required.[1] |
| Refrigerated storerooms | None required | Do. |
| Carpenter, valet, photographic, and printing shops, sales rooms, etc. | Electric, pneumatic, or automatic sprinkling. | Do.[1] |
| *Machinery spaces* | | |
| Coal fired boilers: Bunker and boiler space | None required | None required. |
| Oil fired boilers: Spaces containing oil fired boilers either main or auxiliary, their fuel oil service pumps, and/or such other fuel oil units as the heaters, strainers, valves, manifolds, etc., that are subject to the discharge pressure of the fuel oil service pumps, together with adjacent spaces to which oil can drain. | do | Carbon dioxide or foam. |
| Internal combustion or gas turbine propelling machinery spaces. | do | Carbon dioxide.[6] |
| Electric propulsive motors or generators of open type | do | None required. |
| Enclosed ventilating systems for motors and generators of electric propelling machinery. | do | Carbon dioxide (in ventilating system).[7] |
| Auxiliary spaces, internal combustion or gas turbine | do | Carbon dioxide.[6] |
| Auxiliary spaces, electric motors or generators | do | None required. |
| Auxiliary spaces, steam | do | Do. |
| Trunks to machinery spaces | do | Do. |
| Fuel tanks | do | Do.[9] |
| *Cargo spaces* | | |
| Inaccessible during voyage (combustible cargo), including trunks (excluding tanks). | Smoke detecting | Carbon dioxide.[4] |
| Accessible during voyage (combustible cargo) | Smoke detecting, electric, pneumatic or automatic sprinkling. | Automatic or manual sprinkling. |
| Vehicular deck (except where no overhead deck is 30 feet in length or less). | None required | Manual sprinkling. |
| Cargo oil tanks | do | Carbon dioxide or foam.[4] |

[1] Vessels of 100 gross tons and over contracted for on or before May 27, 1936, and having combustible joiner work shall be fitted with an automatic sprinkling system, except in relatively incombustible spaces.
[2] Sprinkler heads may be attached to sanitary system provided electrical or pneumatic detecting is installed.
[3] On vessels contracted for prior to November 19, 1952, electric or pneumatic detecting may be substituted.
[4] On vessels contracted for prior to January 1, 1962, a steam smothering system may be accepted. However, although existing steam smothering systems may be repaired, replaced, or extended, no new system contracted for on or after January 1, 1962, will be permitted.
[6] Protection of auxiliary boilers, fuel oil units, valves and manifolds not required on vessels contracted for prior to November 19, 1952.
[7] Not required on vessels of less than 300 gross tons (except on an international voyage) using fuel with a flashpoint higher than 110° F., where the space is normally manned.
[9] Not required on vessels contracted for prior to November 19, 1952.
[6] Not required on vessels of less than 300 gross tons nor on vessels contracted for prior to November 19, 1952, except where fuel, including starting fuel, has a flashpoint of 110° F. or less.
[9] Where fuel having a flashpoint of 110° F. or lower is used, the space containing the fuel tanks shall be protected by a carbon dioxide system.

**§ 76.05–15 Fire main system.**

(a) Fire pumps, hydrants, hose, and nozzles shall be installed on the following vessels:

(1) On all self-propelled vessels.

(2) After July 1, 1957, on all barges with sleeping accommodations for more than six persons.

(b) The arrangement and details of the fire main system shall be as set forth in Subpart 76.10.

**§ 76.05–20 Fixed fire extinguishing systems.**

(a) Approved fire extinguishing systems shall be installed, as required by Table 76.05–1(a) on the following vessels:

(1) On all self-propelled vessels.

(2) After July 1, 1957, on all barges with sleeping accommodations for more than six persons.

(b) The arrangements and details of the fixed fire extinguishing systems shall be as set forth in Subparts 76.13 through 76.25.

**§ 76.05–25 Hand portable fire extinguishers and semiportable fire extinguishing systems.**

(a) Approved hand portable fire extinguishers and semiportable fire extinguishing systems shall be installed on all vessels as set forth in Subpart 76.50.

**§ 76.05–30 Sand.**

(a) On vessels of over 1,000 gross tons there shall be in each space containing oil fired boilers a metal receptacle containing not less than 10 cubic feet of sand, sawdust impregnated with soda, or other approved dry materials together with a scoop or shaker for distributing the same. On vessels of 1,000 gross tons or less, at least 5 cubic feet of such materials shall be similarly carried.

(b) In lieu of the requirements in paragraph (a) of this section, one B–II fire extinguisher may be substituted.

## Subpart 76.10—Fire Main System, Details

**§ 76.10–1 Application.**

(a) The provisions of this subpart, with the exception of § 76.10–90, shall apply to all fire main installations contracted for on or after May 26, 1965. Installations contracted for prior to May 26, 1965, shall meet the requirements of § 76.10–90.

**§ 76.10–5 Fire pumps.**

(a) Vessels shall be equipped with independently driven fire pumps in accordance with Table 76.10–5 (a).

TABLE 76.10–5 (a)

| Gross tons | | Minimum number of pumps | | Hose and hydrant size, inches | Nozzle orifice size, inches | Length of hose, feet |
|---|---|---|---|---|---|---|
| Over | Not over | International voyage | Other | | | |
| ------ | 100 | 2 | 1 | 1½ | ½ | 50 |
| 100 | 500 | 2 | 1 | 1½ | ⅝ | 50 |
| 500 | 1,500 | 2 | 2 | 1½ | ⅝ | 50 |
| 1,500 | 4,000 | 2 | 2 | [1] 2½ | [1] 1⅛ | [1] 50 |
| 4,000 | ------ | 3 | 3 | [1] 2½ | [1] 1⅛ | [1] 50 |

[1] 75 feet of 1½-inch hose and ⅝-inch nozzles may be used where specified by § 76.10–10(b).

(b) Vessels on an international voyage shall have a minimum total fire pump capacity at least equal to two-thirds of the required total bilge pump capacity, but in no case less than that required by this section. Each of the required fire pumps shall have a capacity not less than 80 percent of the total required capacity divided by the number of required pumps.

(c) Each pump shall be capable of delivering water simultaneously from the two highest outlets at a Pitot tube pressure of approximately 50 p. s. i. Where one or both of these outlets is a 1½-inch siamese fitting, both branches of the siamese fitting at each such outlet shall be utilized for the purpose of this requirement.

(d) Fire pumps shall be fitted on the discharge side with relief valves set to relieve at 25 p. s. i. in excess of the pressure necessary to maintain the requirements of paragraph (c) of this section or 125 p. s. i., whichever is greater. Relief valves may be omitted if the pumps, operating under shutoff conditions, are not capable of developing a pressure exceeding this amount.

(e) Fire pumps shall be fitted with a pressure gauge on the discharge side of the pumps.

(f) Fire pumps may be used for other purposes provided at least one of the required pumps is kept available for use on the fire system at all times. Unless specifically approved by the Commandant, no branch lines shall be connected to the fire mains for other than fire and deck wash purposes. Other discharge lines shall lead from a discharge manifold near the fire pump. In no case shall a pump having connection to an oil line be used as a fire pump.

(g) The total area of the pipes leading from a pump shall not be less than the discharge area of the pump.

(h) On vessels with oil fired boilers, either main or auxiliary, or with internal combustion propulsion machinery, where 2 fire pumps are required, they shall be located in separate spaces and the arrangement of pumps, sea connections, and sources of power shall be such as to insure that a fire in any one space will not put all of the fire pumps out of operation. However, in vessels of less than 300 feet in length, where it is shown to the satisfaction of the Commandant that it is unreasonable or impracticable to meet this requirement due to the size or arrangement of the vessel, or for other reasons, the installation of a total flooding carbon dioxide system may be accepted as an alternate method of extinguishing any fire which would affect the powering and operation of at least one of the required fire pumps.

**§ 76.10–10 Fire hydrants and hose.**

(a) The size of fire hydrants, hose, and nozzles and the length of hose required shall be as noted in Table 76.10–5 (a).

(b) In lieu of the 2½-inch hose and hydrants specified in Table 76.10–5 (a), on vessels over 1,500 gross tons, the hydrants in interior locations may have siamese connections for 1½-inch hose. In these cases the hose shall be 75 feet in length, and only one hose will be required at each fire station; however, if all such stations can be satisfactorily served with 50-foot lengths, 50-foot hose may be used.

(c) On vessels of 1,000 gross tons and over there shall be at least one shore connection to the fire main available to each side of the vessel in an accessible location. Suitable cut-out valves and check valves shall be provided. Suitable adaptors also shall be provided for furnishing the vessel's shore connections with couplings mating those on the shore fire lines. Such vessels on an international voyage, shall be provided with at least one international shore connection. Facilities shall be available enabling such a connection to be used on either side of the vessel. The international shore connection shall be in accordance with specification Subpart 162.034 of Subchapter Q (Specifications) of this chapter.

(d) Fire hydrants shall be of sufficient number and so located that any part of the vessel, other than main machinery spaces, accessible to the passengers or crew while the vessel is being navigated and all cargo holds may be reached with at least two streams of water from separate outlets, at least one of which shall be from a single length of hose. For the purpose of this requirement, all watertight doors and all doors in main vertical zone bulkheads and stairway enclosures shall be closed, although hose ports may be installed in doors other than watertight doors and doors in main vertical zone bulkheads for the passage of the hose. In main machinery spaces, all portions at such spaces shall be capable of being reached by at least two streams of water, each of which shall be from a single length of hose from separate outlets; however, this requirement need not apply to shaft alleys containing no assigned space for the stowage of combustibles. Fire hydrants shall be numbered as required by § 78.47–20 of this subchapter.

(e) All parts of the fire main located on exposed decks shall either be protected against freezing or be fitted with cut-out valves and drain valves so that the entire exposed parts of such piping may be shut off and drained in freezing weather. Except when closed to prevent freezing, such valves shall be sealed open.

(f) The outlet at the fire hydrant shall be limited to any position from the horizontal to the vertical pointing downward, so that the hose will lead horizontally or downward to minimize the possibility of kinking.

(g) Each fire hydrant shall be provided with a single length of hose with nozzle attached and a spanner. A suitable hose rack or other device shall be provided for the proper stowage of the hose. If the hose is not stowed in the open or behind glass so as to be readily seen, the enclosure shall be marked in accordance with § 78.47–20 of this subchapter.

(h) Fire hose shall be connected to the outlets at all times. However, on open decks where no protection is afforded to the hose in heavy weather, or

where the hose may be liable to damage from the handling of cargo the hose may be temporarily removed from the hydrant and stowed in an accessible nearby location.

(i) Fire hose shall not be used for any other purpose than fire extinguishing and fire drills.

(j) Hose nozzle requirements:

(1) All nozzles shall be of good grade bronze or equivalent metal.

(2) Where smooth bore type nozzles are used, they shall have an orifice of the size indicated in Table 76.10–5 (a).

(3) Where combination solid stream and water spray fire hose nozzles are used, they shall be of approved type. New installations and replacements shall be constructed in accordance with Subpart 162.027 of Subchapter Q (Specifications) of this chapter. The detachable applicator shall be stowed adjacent to the fire hydrant, except where combination nozzles are not required, in which case the applicator may be stowed at the discretion of the master.

(4) Except as noted in subparagraph (5), all hose nozzles shall be of either the smooth bore type or the approved type combination nozzle.

(5) On all vessels on an international voyage, and all other vessels of 1,000 gross tons and over, the hose attached to the hydrants in propulsion machinery spaces containing oil-fired boilers, internal combustion machinery, or oil fuel units shall be fitted with an approved combination nozzle. The applicator shall be not more than 6 feet in length.

(6) Where approved combination nozzles are used but not required, the applicator with low velocity fog spray head and the self-cleaning strainer may be fitted but will not be required.

(k) Fire hydrants, nozzles, and other fittings shall have threads to accommodate the hose connections noted in paragraph (l) of this section.

(l) Firehose and couplings requirements:

(1) Couplings shall be of brass, bronze, or other equivalent metal. For installations on vessels contracted for on or after July 1, 1954, National Standard fire hose coupling threads shall be used for the 1½-inch and 2½-inch sizes, i. e., 9 threads per inch for 1½-inch hose and 7½ threads per inch for 2½-inch hose.

(2) Unlined hose shall not be used in the machinery spaces.

(3) All lined and unlined hose installed after January 1, 1961, shall be of fire hose quality, in conformance with Underwriters' Laboratories, Inc., Standard 18 or 19, or Federal Specification JJ–H–571 or ZZ–H–451a. Hose which bears the label of Underwriters' Laboratories, Inc., as inspected lined or unlined fire hose will be accepted as conforming to this requirement.

### § 76.10–15 Piping.

(a) All piping, valves, and fittings shall meet the applicable requirements of Subchapter F (Marine Engineering) of this chapter.

(b) All distribution cut-off valves shall be marked as required by § 78.47–15 of this subchapter.

(c) For vessels on an international voyage, the diameter of the fire main shall be sufficient for the effective distribution of the maximum required discharge from two fire pumps operating simultaneously. This is in addition to § 76.10–5(c). The discharge of this quantity of water through hoses and nozzles at a sufficient number of adjacent hydrants shall be at a minimum Pitot tube pressure of approximately 50 pounds per square inch.

### § 76.10–90 Installations contracted for prior to May 26, 1965.

(a) Installations contracted for prior to May 26, 1965, shall meet the following requirements:

(1) Except as specifically modified by this paragraph, the requirements of §§ 76.10–5 through 76.10–15 shall be complied with insofar as the number and general type of equipment is concerned. Existing equipment previously approved, but not meeting the applicable requirements of §§ 76.10–5 through 76.10–15 may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs, alterations, and replacements may be permitted to the same standards as the original installation. However, all new installations or major replacements shall meet the applicable requirements in this part.

(2) All vessels contracted for prior to November 19, 1952, shall be fitted with fire pumps, hoses, and nozzles in accordance with Table 76.10–90(a)(2).

[illegible] 76.10–90(a)(2)

| Gross tons | | Minimum number of pumps | Minimum hose and hydrant size, inches | Nozzle orifice size, inches | Length of hose, feet |
|---|---|---|---|---|---|
| Over | Not over | | | | |
| 100 | 4,000 | 2 | [1] 1½ | [1] ⅝ | [1] 50 |
| 4,000 | ..... | 3 | [1] 1½ | [1] ⅝ | [1] 50 |

[1] May use 50 feet of 2½-inch hose with 1⅛-inch nozzles for exterior stations. May use 75 feet of 1½-inch hose with ⅝-inch nozzles for interior station in which case such interior stations shall have siamese connections.

(3) When reasonable and practicable, where two or more fire pumps are required, they shall not all be located in the same space.

(4) The general requirements of §§ 76.10–5 (c) through (h), 76.10–10 (d) through (i), and § 76.10–15 shall be complied with insofar as is reasonable and practicable.

## Subpart 76.13—Steam Smothering System, Details

### § 76.13–1 Application.

(a) In accordance with §§ 76.05–1 and 76.05–20, steam smothering systems are not permitted on vessels contracted for on or after January 1, 1962, nor for new installations on vessels contracted for prior to that date.

(b) Where a steam smothering system is installed, the provisions of this subpart shall apply.

(c) This does not preclude the introduction of steam into such confined spaces as boiler casings or into tanks for steaming out purposes. Such installations are not to be considered as part of any required fire extinguishing system.

### § 76.13–90 Installations contracted for prior to January 1, 1962.

(a) Installations contracted for prior to July 1, 1935, shall meet the following requirements:

(1) Existing arrangements, materials, and facilities previously approved will be considered satisfactory so long as they meet the minimum requirements of this paragraph and they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standard as the original installation.

(2) The main pipes and their branches to the cargo compartments and similar spaces shall be not less than 1½-inch pipe size and shall emanate from not more than two stations in easily accessible locations. If located on the open deck, the distribution manifolds shall be suitably protected by an enclosing cabinet or casing which shall be marked as required by § 78.47–17 of this subchapter. Each branch line shall have a valve at the manifold which shall be marked as required by § 78.47–15 of this subchapter.

(3) Branches to paint lockers and similar small spaces may be taken from the nearest steam supply line and shall be not less than ¾-inch pipe size. The valve shall be marked as required by § 78.47–15 of this subchapter.

(b) Installations contracted for on or after July 1, 1935, but prior to November 19, 1952, shall meet the following requirements:

(1) Existing arrangements, materials and facilities previously approved will be considered satisfactory so long as they meet the minimum requirements of this paragraph and they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs, and alterations may be made to the same standard as the original installation.

(2) Steam shall be available from the main or auxiliary boilers to provide at least one pound of steam per hour for each 50 cubic feet of gross volume of the largest compartment protected. Where reasonable and practicable, the steam pressure shall be at least 100 p. s. i.

(3) The piping system shall meet the general requirements of subparagraphs (5) through (12) of paragraph (c) of this section insofar as is reasonable and practicable.

(4) The minimum size of distribution piping and the number of branches to the various spaces shall be as given in Table 76.13–90 (b) (4) or by the following formula:

$$D=\sqrt{\frac{C}{30{,}000}} \qquad (1)$$

where:

$D$=Required diameter of pipe in inches.

$C$=Volume of compartment in cubic feet.

TABLE 76.13-90 (b) (4)

| Volume of compartment in cubic feet | | Number of branches to compartment | Pipe size in each branch, inches |
|---|---|---|---|
| Over | Not over | | |
| ------- | 30,000 | 1 | 1 |
| 30,000 | 46,000 | 1 | 1¼ |
| 46,000 | 67,000 | 1 | 1½ |
| 67,000 | 94,000 | 2 | 1¼ |
| 94,000 | 135,000 | 2 | 1½ |
| 135,000 | 200,000 | 3 | 1½ |

(5) The minimum size of the steam supply line from the boiler to the distribution manifold shall be as given by the following formula:

$$D=\sqrt{\frac{C}{60{,}000}} \qquad (2)$$

where:

$D$=Diameter of pipe in inches.

$C$=Volume of all compartments in cubic feet.

(c) Installations contracted for on or after November 19, 1952, but prior to January 1, 1962, shall meet the following requirements:

(1) Existing arrangements, materials and facilities previously approved will be considered satisfactory so long as they meet the minimum requirements of this paragraph and they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standard as the original installation.

(2) Steam shall be available from main or auxiliary boilers to provide at least one pound of steam per hour for each 12 cubic feet of the gross volume of the largest compartment to be protected.

(3) Although separate piping shall be led to each cargo hold and 'tween deck, for the purpose of determining the amount of steam required, a cargo compartment will be considered as the space between adjacent watertight or firescreen bulkheads and from tank top or lowest deck to the deck head of the uppermost deck on which cargo may be carried. If a trunk extends beyond such deck, the trunk space shall be included. Tonnage openings shall be considered as sealed for this purpose.

(4) A steam pressure of at least 100 p.s.i. shall be available unless specifically approved otherwise.

(5) All piping, valves, and fittings shall meet the applicable requirements of Subchapter F (Marine Engineering) of this chapter.

(6) The distribution piping shall emanate from not more than three stations in easily accessible locations on the weather deck, and shall lead to the lower portion of each cargo hold, cargo 'tween deck, and other compartments protected. However, lines to paint lockers and similar small spaces may be taken from the nearest steam supply line.

(7) The distribution line to each compartment shall be fitted with a shutoff valve. The valve shall be marked as required by § 78.47-15 of this subchapter.

(8) The manifold steam supply line shall be fitted with a master valve at the manifold.

(9) Provisions shall be made for draining the manifold and distribution lines to prevent them from freezing.

(10) If located on the open deck, the distribution manifolds shall be suitably protected by an enclosing cabinet or casing. In any case, it shall be marked as required by § 78.47-17 of this subchapter.

(11) Piping shall not be led into or through spaces accessible to the passengers or crew while the vessel is being navigated, with the exception of machinery spaces and corridors. However, in special cases, arrangements to run piping through such spaces may be specifically approved by the Commandant, provided all joints are welded, suitable expansion bends are provided, and all piping is extra heavy.

(12) Piping shall be used for no other purpose except that it may be incorporated with the fire detecting system, and where suitable provisions are made, it may be used for steaming out tanks.

(13) The minimum size and number of branches to the various spaces shall be as given in Table 76.13-90(c)(13). The distribution piping from the manifold to the branch lines shall have an area approximately equal to the combined areas of the branch lines served.

TABLE 76.13-90 (c)(13)

| Volume of spaces in cubic feet | | Number of branches to spaces | Pipe size of each branch, inches |
|---|---|---|---|
| Over | Not over | | |
| ------- | 500 | 1 | ¾ |
| 500 | 5,000 | 1 | 1 |
| 5,000 | 15,000 | 1 | 1¼ |
| 15,000 | 30,000 | 1 | 1½ |
| 30,000 | 50,000 | 2 | 1¼ |
| 50,000 | 80,000 | 3 | 1½ |
| 80,000 | 100,000 | 3 | 1½ |
| 100,000 | 130,000 | 4 | 1½ |

(14) The steam supply line from the boiler to any distribution manifold shall be of sufficient size to supply all the branch lines to the largest compartment and to all adjacent compartments.

## Subpart 76.15—Carbon Dioxide Extinguishing Systems, Details

### § 76.15-1 Application.

(a) Where a carbon dioxide extinguishing system is installed, the provisions of this subpart, with the exception of § 76.15-90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of § 76.15-90.

(b) The requirements of this subpart are based on a "high pressure system", i.e., one in which the carbon dioxide is stored in liquid form at atmospheric temperature. Details for "low pressure systems", i.e., those in which the carbon dioxide is stored in liquid form at a continuously controlled low temperature, may be specifically approved by the Commandant where it is demonstrated that a comparable degree of safety and fire extinguishing ability is achieved.

### § 76.15-5 Quantity, pipe sizes, and discharge rate.

(a) *General.* The amount of carbon dioxide required for each space shall be as determined by the following paragraphs in this section.

(b) *Total available supply.* A separate supply of carbon dioxide need not be provided for each space protected. The total available supply shall be at least sufficient for the space requiring the greatest amount.

(c) *Cargo spaces.* (1) The number of pounds of carbon dioxide required for each space in cubic feet shall be equal to the gross volume of the space in cubic feet divided by 30.

(2) Although separate piping shall be led to each cargo hold and 'tween deck, for the purpose of determining the amount of carbon dioxide required, a cargo compartment will be considered as the space between adjacent watertight or firescreen bulkheads and from the tank top or lowest deck to the deck head of the uppermost space on which cargo may be carried. If a trunk extends beyond such deck, the trunk volume shall be included. Tonnage openings shall be considered as sealed for this purpose.

(3) Branch lines to the various cargo holds and 'tween decks shall not be less than ¾ inch standard pipe size.

(4) No specific discharge rate need be applied to such systems.

(d) *Enclosed ventilation systems for rotating electrical propulsion equipment.* (1) The number of pounds of carbon dioxide required for the initial charge shall be equal to the gross volume of the system divided by 10 for systems having a volume of less than 2,000 cubic feet, and divided by 12 for systems having a volume of 2,000 cubic feet or more.

(2) The piping for the initial charge shall be in accordance with Table 76.15-5 (e) (4), and the discharge of the required amount shall be completed within two minutes.

(3) In addition to the above there shall be sufficient carbon dioxide available to permit delayed discharges of such quantity as to maintain at least a 25 percent concentration until the equipment can be stopped. If the initial discharge is such as to achieve this concentration until the equipment is stopped, no delayed discharge need be provided.

(4) The piping for the delayed discharge shall not be less than ½ inch standard pipe size, and no specific discharge rate need be applied to such systems. On small systems, this pipe may be incorporated with the initial discharge piping.

(e) *Machinery spaces, paint lockers, tanks, and similar spaces.* (1) Except as provided in subparagraph (3) of this paragraph, the number of pounds of carbon dioxide required for each space shall be equal to the gross volume of the space divided by the appropriate factor noted in Table 76.15-5(e)(1). If fuel can drain from the compartment being protected to an adjacent compartment, or if the compartments are not entirely separate, the requirements for both compartments shall be used to determine the amount of carbon dioxide to be provided. The carbon dioxide shall be arranged to discharge into both such compartments simultaneously.

TABLE 76.15-5(c)(1)

| Gross volume of compartment, cubic feet | | Factor |
|---|---|---|
| Over | Not over | |
| ---------- | 500 | 15 |
| 500 | 1,600 | 16 |
| 1,600 | 4,500 | 18 |
| 4,500 | 50,000 | 20 |
| 50,000 | ---------- | 22 |

(2) For the purpose of the above requirement of this paragraph, the volume of a machinery space shall be taken as exclusive of the normal machinery casing unless the boiler, internal combustion machinery, or fuel oil installations extend into such space in which case the volume shall be taken to the top of the casing or the next material reduction in casing area, whichever is lower. For installations contracted for on or after October 1, 1959, "normal machinery casing" and "material reduction in casing area" shall be defined as follows:

(i) By "normal machinery casing" shall be meant a casing the area of which is not more than 40 percent of the maximum area of the machinery space.

(ii) By "material reduction in casing area" shall be meant a reduction to at least 40 percent of the casing area.

(3) For vessels on an international voyage contracted for on or after May 26, 1965, the amount of carbon dioxide required for a space containing propulsion boilers or internal combustion propulsion machinery shall be as given by subparagraphs (1) and (2) of this paragraph or by dividing the entire volume, including the casing, by a factor of 25, whichever is the larger.

(4) Branch lines to the various spaces shall be as noted in Table 76.15-5(c)(4).

TABLE 76.15-5(c)(4)

| Maximum quantity of carbon dioxide required, pounds | Minimum nominal pipe size, inches | Maximum quantity of carbon dioxide required, pounds | Minimum nominal pipe size, inches |
|---|---|---|---|
| 100 | ¼ | 2,800 | 2½ |
| 225 | ¾ | 4,450 | 3 |
| 300 | 1 | 7,100 | 3½ |
| 600 | 1¼ | 10,450 | 4 |
| 1,000 | 1½ | 15,000 | 4½ |
| 2,450 | 2 | | |

(5) Distribution piping within the space shall be proportioned from the supply line to give proper distribution to the outlets without throttling.

(6) The number, type, and location of discharge outlets shall be such as to give a uniform distribution throughout the space.

(7) The total area of all discharge outlets shall not exceed 85 percent nor be less than 35 percent of the nominal cylinder outlet area or the area of the supply pipe, whichever is smaller. The nominal cylinder outlet area in square inches shall be determined by multiplying the factor 0.0022 by the number of pounds of carbon dioxide required, except that in no case shall this outlet area be less than 0.110 square inch.

(8) The discharge of at least 85 percent of the required amount of carbon dioxide shall be complete within 2 minutes.

**§ 76.15-10 Controls.**

(a) Except as noted in § 76.15-20 (b), all controls and valves for the operation of the system shall be outside the space protected, and shall not be located in any space that might be cut off or made inaccessible in the event of fire in any of the spaces protected.

(b) If the same cylinders are used to protect more than one hazard, a manifold with normally closed stop valves shall be used to direct the carbon dioxide into the proper space. If cylinders are used to protect only one hazard, a normally closed stop valve shall be installed between the cylinders and the hazard except for systems of the type indicated in § 76.15-5 (e) which contain not more than 300 pounds of carbon dioxide.

(c) Distribution piping to the various cargo spaces shall be controlled from not more than two stations. One of the stations controlling the system for the main machinery space shall be located as convenient as practicable to one of the main escapes from the space. All control stations and the individual valves and controls shall be marked as required by §§ 78.47-15 and 78.47-17 of this subchapter.

(d) Systems of the type indicated in § 76.15-5 (e) shall be actuated by one control operating the valve to the space and a separate control releasing at least the required amount of carbon dioxide. These two controls shall be located in a box or other enclosure clearly identified for the particular space. Those systems installed without a stop valve shall be operated by one control releasing at least the required amount of carbon dioxide.

(e) Where provisions are made for the simultaneous release of a given amount of carbon dioxide by operation of a remote control, provisions shall also be made for manual control at the cylinders. Where gas pressure from pilot cylinders is used as a means for releasing the remaining cylinders, not less than two pilot cylinders shall be used for systems consisting of more than two cylinders. Each of the pilot cylinders shall be capable of manual control at the cylinder, but the remaining cylinders need not be capable of individual manual control.

(f) Systems of the type indicated in § 76.15-5 (e), other than systems for tanks, which are of more than 300 pounds of carbon dioxide, shall be fitted with an approved delayed discharge so arranged that the alarm will be sounded for at least 20 seconds before the carbon dioxide is released into the space. Such systems of not more than 300 pounds of carbon dioxide shall also have a similar delayed discharge, except for those systems for tanks and for spaces which have a suitable horizontal escape. This paragraph shall be applicable only to systems installed on or after July 1, 1957.

(g) All distribution valves and controls shall be of an approved type. All controls shall be suitably protected.

(h) Complete but simple instructions for the operation of the system shall be located in a conspicuous place at or near the releasing control device.

(i) If the space or enclosure containing the carbon dioxide supply or controls is to be locked, a key to the space or enclosure shall be in a break-glass-type box conspicuously located adjacent to the opening.

**§ 76.15-15 Piping.**

(a) The piping, valves, and fittings shall have a bursting pressure of not less than 6,000 p. s. i.

(b) All piping, in nominal sizes not over ¾ inch, shall be at least Schedule 40 (standard weight), and in nominal sizes over ¾ inch, shall be at least Schedule 80 (extra heavy).

(c) All piping, valves, and fittings of ferrous materials shall be protected inside and outside against corrosion unless specifically approved otherwise by the Commandant.

(d) A pressure relief valve or equivalent set to relieve between 2,400 and 2,800 p. s. i. shall be installed in the distributing manifold or such other location as to protect the piping in the event that all branch line shut-off valves are closed.

(e) All dead end lines shall extend at least 2 inches beyond the last orifice and shall be closed with cap or plug.

(f) All piping, valves, and fittings shall be securely supported, and where necessary, protected against injury.

(g) Drains and dirt traps shall be fitted where necessary to prevent the accumulation of dirt or moisture. Drains and dirt traps shall be located in accessible locations where possible.

(h) Piping shall be used for no other purpose except that it may be incorporated with the fire detecting system.

(i) Piping passing through living quarters shall not be fitted with drains or other openings within such spaces.

(j) Installation test requirements:

(1) Upon completion of the piping installation, and before the cylinders are connected, a pressure test shall be applied as set forth in this paragraph. Only carbon dioxide or other inert gas shall be used for this test.

(2) The piping from the cylinders to the stop valves in the manifold shall be subjected to a pressure of 1,000 p. s. i. With no additional gas being introduced to the system, it shall be demonstrated that the leakage of the system is such as not to permit a pressure drop of more than 150 p. s. i. per minute for a 2-minute period.

(3) The individual branch lines to the various spaces protected shall be subjected to a test similar to that described in the preceding subparagraph with the exception that the pressure used shall be 600 p. s. i. in lieu of 1,000 p. s. i. For the purpose of this test, the distribution piping shall be capped within the space protected at the first joint ahead of the nozzles.

(4) In lieu of the tests prescribed in the preceding subparagraphs in this paragraph, small independent systems protecting spaces such as emergency generator rooms, lamp lockers, etc., may be tested by blowing out the piping with air at a pressure of at least 100 p. s. i.

**§ 76.15–20 Carbon dioxide storage.**

(a) Except as provided in paragraph (b) of this section, the cylinders shall be located outside the spaces protected, and shall not be located in any space that might be cut off or made inaccessible in the event of a fire in any of the spaces protected.

(b) Systems of the type indicated in § 76.15–5 (e), consisting of not more than 300 pounds of carbon dioxide, may have the cylinders located within the space protected. If the cylinder stowage is within the space protected, the system shall be arranged in an approved manner to be automatically operated by a heat actuator within the space in addition to the regular remote and local controls.

(c) The space containing the cylinders shall be properly ventilated and designed to preclude an anticipated ambient temperature in excess of 130 degrees F.

(d) Cylinders shall be securely fastened and supported, and, where necessary, protected against injury.

(e) Cylinders shall be so mounted as to be readily accessible and capable of easy removal for recharging and inspection. Provisions shall be available for weighing the cylinders.

(f) Where subject to moisture, cylinders shall be so installed as to provide a space of at least 2 inches between the flooring and the bottom of the cylinders.

(g) Cylinders shall be mounted in an upright position or inclined not more than 30 degrees from the vertical. However, cylinders which are fitted with flexible or bent syphon tubes may be inclined not more than 80 degrees from the vertical.

(h) Where check valves are not fitted on each independent cylinder discharge, plugs or caps shall be provided for closing outlets when cylinders are removed for inspection or refilling.

(i) All cylinders used for storing carbon dioxide shall be fabricated, tested, and marked in accordance with the regulations of the Interstate Commerce Commission as noted in § 147.04–1 of Subchapter N (Dangerous Cargoes) of this chapter.

**§ 76.15–25 Discharge outlets.**

(a) Discharge outlets shall be of an approved type.

**§ 76.15–30 Alarms.**

(a) Spaces which are protected by a carbon dioxide extinguishing system and are normally accessible to persons on board while the vessel is being navigated, other than paint and lamp lockers and similar small spaces, shall be fitted with an approved audible alarm in such spaces which will be automatically sounded when the carbon dioxide is admitted to the space. The alarm shall be conspicuously and centrally located and shall be marked as required by § 78.47–9 of this subchapter. For systems installed on or after July 1, 1957, alarms will be mandatory only for systems required to be fitted with a delayed discharge. Such alarms shall be so arranged as to sound during the 20 second delay period prior to the discharge of carbon dioxide into the space, and the alarm shall depend on no source of power other than the carbon dioxide.

**§ 76.15–35 Enclosure openings.**

(a) Where mechanical ventilation is provided for spaces other than cargo and similar spaces which are protected by a carbon dioxide extinguishing system, provisions shall be made so that the ventilation system is automatically shutdown with the operation of the system to that space.

(b) Where natural ventilation is provided for spaces protected by a carbon dioxide extinguishing system, provisions shall be made for easily and effectively closing off the ventilation.

(c) Means shall be provided for closing all openings to the space protected from outside such space. In this respect, relatively tight doors, shutters, or dampers shall be provided for openings in the lower portion of the space. The construction shall be such that openings in the upper portion of the space can be closed off either by permanently installed means or by the use of canvas or other material which is normally carried by the vessel.

**§ 76.15–40 Pressure relief.**

(a) Where necessary, relatively tight compartment such as refrigeration spaces, paint lockers, etc., shall be provided with suitable means for relieving excessive pressure accumulating within the compartment when the carbon dioxide is injected.

**§ 76.15–90 Installations contracted for prior to November 19, 1952.**

(a) Installations contracted for prior to November 19, 1952, shall meet the following requirements:

(1) Existing arrangements, materials, and facilities previously approved shall be considered satisfactory so long as they meet the minimum requirements of this paragraph and they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standards as the original installation.

(2) The details of the systems shall be in general agreement with §§ 76.15–5 through 76.15–40 insofar as is reasonable and practicable, with the exception of § 76.15–5 (e) (1), (2) and (4), covering spaces other than cargo spaces, which systems may be installed in accordance with subparagraphs (3) through (6) of this paragraph.

(3) In boilerrooms, the bilges shall be protected by a system discharging principally below the floor plates. Perforated pipe may be used in lieu of discharge nozzles for such systems. The number of pounds of carbon dioxide shall be equal to the gross volume of the boiler room taken to the top of the boilers divided by 36. In the event of an elevated boilerroom which drains to the machinery space, the system shall be installed in the engine room bilge and the gross volume shall be taken to the flat on which the boilers are installed.

(4) In machinery spaces where main propulsion internal combustion machinery is installed, the number of pounds of carbon dioxide required shall be equal to the gross volume of the space taken to the underside of the deck forming the hatch opening divided by 22.

(5) In miscellaneous spaces other than cargo or main machinery spaces, the number of pounds of carbon dioxide required shall be equal to the gross volume of the space divided by 22.

(6) Branch lines to the various spaces, other than cargo and similar spaces, shall be as noted in Table 76.15–90 (a) (6). This table is based on cylinders having discharge outlets and siphon tubes of ⅜-inch diameter.

TABLE 76.15–90 (a) (6)

| Number of cylinders | | Nominal pipe size | |
|---|---|---|---|
| Over | Not over | Inches | Type |
| ---- | 2 | ½ | Standard. |
| 2 | 4 | ¾ | Do. |
| 4 | 6 | 1 | Extra heavy. |
| 6 | 12 | 1¼ | Do. |
| 12 | 16 | 1½ | Do. |
| 16 | 27 | 2 | Do. |
| 27 | 39 | 2½ | Do. |
| 39 | 60 | 3 | Do. |
| 60 | 80 | 3½ | Do. |
| 80 | 104 | 4 | Do. |
| 104 | 165 | 5 | Do. |

## Subpart 76.17—Foam Extinguishing Systems, Details

**§ 76.17–1 Application.**

(a) Where a foam extinguishing system is installed, the provisions of this subpart, with the exception of § 76.17–90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of § 76.17–90.

**§ 76.17–5 Quantity of foam required.**

(a) *Area protected.* (1) For machinery and similar spaces, the system shall be so designed and arranged as to spread a blanket of foam over the entire tank top or bilge of the space protected. The arrangement of piping shall be such as to give a uniform distribution over the entire area protected.

(2) Where an installation is made to protect an oil fired boiler installation on a flat which is open to or can drain to the lower engine room or other space, both the flat and the lower space shall be protected simultaneously. The flat shall be fitted with suitable coamings on all openings other than deck drains to properly restrain the oil and foam at that level. Other installations of a similar nature will be considered in a like manner.

(3) Where a system is installed to protect a tank, it shall be so designed and arranged as to spread a blanket of foam over the entire liquid surface of the tank within the range of usual trim. The arrangement of piping shall be such as to give a uniform distribution over the entire area protected.

(b) *Rate of application.* (1) For spaces other than tanks, the rate of discharge to foam outlets protecting the

hazard shall be at least as set forth in this subparagraph.

(i) For chemical foam systems with stored "A" and "B" solutions, a total of at least 1.6 gallons per minute of the two solutions shall be discharged for each 10 square feet of area protected.

(ii) For other types of foam systems, the water rate to the dry powder generators or air foam production equipment shall be at least 1.6 gallons per minute for each 10 square feet of area protected.

(2) For tanks, the rate of discharge to foam outlets protecting the hazard shall be as set forth in subparagraph (1) of this paragraph, except that the value of 1 gallon per minute shall be substituted in both cases for the value of 1.6 gallons per minute.

(c) *Supply of foam producing material.* (1) There shall be provided a quantity of foam producing material sufficient to operate the equipment at the discharge rate specified in paragraph (b) of this section for a period of at least 3 minutes for spaces other than tanks, and for at least 5 minutes for tanks.

(2) A separate supply of foam agent need not be provided for each space protected. The total available supply shall be at least sufficient for the space requiring the greatest amount.

(3) Where pumps are required, the water supply shall be from outside the space protected and shall in no way be dependent upon power from the space protected.

### § 76.17–10 Controls.

(a) The foam agent, its container, and all controls and valves for the operation of the system shall be of an approved type.

(b) The foam agent container and all controls and valves for the operation of the system shall be outside the space protected and shall not be located in such space as might be cut off or made inaccessible in the event of fire in any of the spaces protected. The control space shall be as convenient as practicable to one of the main escapes from spaces protected, and shall be marked as required by § 78.47–17 of this subchapter. Where pumps are required, it shall not be necessary that they be started from the control space.

(c) Complete, but simple instructions for the operation of the system shall be located in a conspicuous place at or near the controls.

(d) The valves to the various spaces served shall be marked as required by § 78.47–15 of this chapter.

### § 76.17–15 Piping.

(a) All piping, valves, and fittings shall meet the applicable requirements of Subchapter F (Marine Engineering) of this chapter.

(b) All piping, valves, and fittings of ferrous materials shall be protected inside and outside against corrosion unless specifically approved otherwise by the Commandant.

(c) All piping, valves, and fittings shall be securely supported, and where necessary, protected against injury.

(d) Drains and dirt traps shall be fitted where necessary to prevent the accumulation of dirt or moisture.

(e) Piping shall be used for no other purpose.

### § 76.17–20 Discharge outlets.

(a) Discharge outlets shall be of an approved type.

### § 76.17–25 Additional protection required.

(a) In order that any residual fires above the floor plates may be extinguished when a foam system is installed for the protection of spaces other than tanks, at least 2 fire hydrants, in addition to those required for the machinery space by Subpart 76.10, shall be installed outside of the machinery space entrances. Such hydrants shall be fitted with sufficient hose so that any part of the machinery space may be reached with at least 2 streams of water, and each hose shall be equipped with an approved combination nozzle, applicator, and self-cleaning strainer as described in § 76.10–10(j)(3).

### § 76.17–90 Installations contracted for prior to November 19, 1952.

(a) Installation contracted for prior to November 19, 1952, shall meet the following requirements:

(1) Existing arrangements, materials, and facilities previously approved shall be considered satisfactory so long as they meet the minimum requirements of this paragraph and they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standards as the original installation.

(2) The details of the systems shall be in general agreement with §§ 76.17–5 through 76.17–20, with the exception of § 76.17–5 (a) (2), insofar as is reasonable and practicable. A 6-inch blanket of foam in 5 minutes for tanks and 3 minutes for other spaces will be considered as meeting the requirements of § 76.17–5.

## Subpart 76.23—Manual Sprinkling System, Details

### § 76.23–1 Application.

(a) Where a manual sprinkling system is installed, the provisions of this subpart, with the exception of § 76.23–90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of § 76.23–90.

### § 76.23–5 Zoning.

(a) Separate zones may be used for each deck, and on any particular deck, spaces separated by "A" or "B" Class bulkheads may be separately zoned.

(b) On any particular deck, large common areas may be zoned in accordance with Table 76.23–5 (b). All such zones within one common area shall be of approximately the same size. Zones of this type shall overlap in such a manner that the end sprinkler heads of both adjoining zones will cover the identical area.

TABLE 76.23–5 (b)

| Square feet of common deck area | | Maximum number of zones |
|---|---|---|
| Over | Not over | |
| ---------- | 800 | 1 |
| 800 | 1,800 | 2 |
| 1,800 | 3,000 | 3 |
| 3,000 | 5,000 | 4 |
| 5,000 | 9,000 | 5 |
| 9,000 | 16,000 | 6 |
| 16,000 | 30,000 | 7 |
| 30,000 | ---------- | 8 |

### § 76.23–10 Quantity, pipe sizes, and discharge rates.

(a) *General.* (1) The system shall be so designed and arranged that the overhead is effectively sprayed and all portions of the deck are covered. The capacity shall be such that at least 12 gallons of water per minute are applied to each 100 square feet of deck area.

(2) Piping, fittings, sprinkler heads, and pumps installed in accordance with the remainder of this section will be considered as meeting the above requirements. If alternate sizes or arrangements are used, it shall be demonstrated that these minimum requirements have been met.

(b) *Sprinkler heads.* (1) Three-eighth inch open type sprinkler heads shall be used. Sprinkler heads shall be so arranged that no portion of the overhead is more than 7 feet from a sprinkler head.

(c) *Pipe sizes.* (1) The various pipe sizes shall be in proportion to the number of heads served. Minimum pipe sizes shall be as given in Table 76.23–10 (c).

TABLE 76.23–10 (c)

| Number of ½ inch heads served | | Minimum nominal pipe sizes, inches |
|---|---|---|
| Over | Not over | |
| ---- | 1 | ¾ |
| 1 | 2 | 1 |
| 2 | 4 | 1¼ |
| 4 | 6 | 1½ |
| 6 | 12 | 2 |
| 12 | 18 | 2½ |
| 18 | 30 | 3 |
| 30 | 46 | 3½ |
| 46 | 66 | 4 |
| 66 | 120 | 5 |

(d) *Fire pumps.* (1) The fire pumps may be used for the sprinkling system provided there is sufficient total capacity to operate the largest zone of the sprinkling system with a Pitot tube pressure of at least 15 p. s. i. at all heads and at the same time to deliver water from the two highest fire hose outlets in a manner similar to that described in § 76.10–5 (c). In addition, on vessels over 750 gross tons, there shall be sufficient pumping capacity to also operate the second largest zone.

### § 76.23–15 Controls.

(a) The controls for the system shall be outside the spaces protected, and shall not be located in such space as might be cut off or made inaccessible in the event of fire in any of the spaces protected. The control space shall be marked as required by § 78.47–15 of this

subchapter. It shall not be necessary to start the pumps from the control space.

(b) Distribution piping to the various zones shall be controlled from one station. Each branch line to the various zones shall be fitted with a stop valve which shall be marked as required by § 78.47–15 of this subchapter.

**§ 76.23–20 Piping.**

(a) All piping, valves, and fittings shall meet the applicable requirements of Subchapter F (Marine Engineering) of this chapter.

(b) All piping, valves, and fittings of ferrous materials shall be protected inside and outside against corrosion unless specifically approved by the Commandant.

(c) All piping, valves, fittings, and sprinkler heads shall be securely supported, and where necessary, protected against injury.

(d) Drains and dirt traps shall be fitted where necessary to prevent the accumulation of dirt or moisture.

(e) Piping shall be used for no other purpose.

**§ 76.23–25 Sprinkler heads.**

(a) Sprinkler heads shall be of an approved type.

**§ 76.23–90 Installations contracted for prior to November 19, 1952.**

(a) Installations contracted for prior to November 19, 1952, shall meet the following requirements:

(1) Existing arrangements, materials, and facilities previously approved shall be considered satisfactory so long as they meet the minimum requirements of this paragraph and they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and replacements may be made to the same standards as the original installation.

(2) The details of the system shall be in general agreement with §§ 76.23–5 through 76.23–25 insofar as is reasonable and practicable. Existing piping, pumping facilities, and sprinkler heads or perforated pipes may be retained provided all portions of the overhead are effectively sprayed and all portions of the deck are covered.

## Subpart 76.25—Automatic Sprinkling System, Details

**§ 76.25–1 Application.**

(a) Where an automatic sprinkling system is installed, the provisions of this subpart, with the exception of § 76.25–90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of § 76.25–90.

**§ 76.25–5 Zoning.**

(a) The automatic sprinkling system shall be divided into separate zones to restrict the area covered by any particular alarm signal.

(b) No sprinkling zone shall contain more than 250 sprinkler heads.

(c) The sprinkling zone may cover more than one deck, in which case, the boundaries shall be maintained in a vertical line insofar as is reasonable and practicable. The boundaries of the zone shall be coincident with bulkheads of Class "A" construction such as main vertical zone or watertight bulkheads.

(d) Spaces in different main vertical zones shall not be included in the same sprinkling zone.

**§ 76.25–10 Size and arrangement of sprinkler heads and pipe sizes.**

(a) *General.* (1) The system shall be so designed and arranged that the overhead is effectively sprayed and that all portions of the deck are covered.

(2) One-half inch sprinkler heads shall be used. Sprinkler heads shall be so arranged that no portion of the overhead or vertical projection of the deck is more than 7 feet from a sprinkler head.

(b) *Pipe sizes.* (1) The sizes of branch lines, single cross mains, feed mains, and risers shall be in proportion to the number of sprinkler heads served. The minimum pipe sizes shall be as given in Table 76.25–10 (b) (1).

TABLE 76.25–10 (b) (1)

| Minimum nominal pipe size, inches | Maximum number of heads served | |
|---|---|---|
| | Vessels whose construction is more combustible than that set forth in §§ 72.05–5 through 72.05–60 | Vessels constructed in general agreement with §§ 72.05–5 through 72.05–60 |
| 1 | 2 | 2 |
| 1¼ | 3 | 3 |
| 1½ | [illegible] | [illegible] |
| [illegible] | 10 | 10 |
| 2½ | 20 | 40 |
| 3 | [illegible] | 160 |
| 3½ | [illegible] | ---------- |
| 4 | 100 | ---------- |
| [illegible] | [illegible] | ---------- |
| [illegible] | 250 | ---------- |

(2) If a complete loop cross main is employed, the size of such cross main shall be in proportion to the number of sprinkler heads served. The minimum pipe sizes shall be as given in Table 76.25–10 (b) (2). The entire loop shall be of the same size pipe.

TABLE 76.25–10 (b) (2)

| Minimum nominal pipe size inches | Maximum number of heads served | |
|---|---|---|
| | Vessels whose construction is more combustible than that set forth in §§ 72.05–5 through 72.05–60 | Vessels constructed in general agreement with §§ 72.05–5 through 72.05–60 |
| 1 | [illegible] | 5 |
| 1¼ | 9 | 9 |
| 1½ | 13 | 13 |
| 2 | 22 | 36 |
| 2½ | 40 | 80 |
| 3 | [illegible] | 250 |
| [illegible] | 150 | ---------- |
| 4 | 250 | ---------- |

**§ 76.25–15 Pumps and water supply.**

(a) An automatically controlled pump shall be provided to supply the sprinkling system and shall be used for no other purpose. The size and capacity of the pump shall be governed by the zone having the greatest capacity need for any one deck, and shall be suitable to operate at least the number of heads noted in Table 76.25–15 (a) with a Pitot tube pressure of at least 15 p. s. i. at all heads (approximately 20 GPM per head). There shall also be sufficient pumping capacity available, either from the automatic pump, the fire pumps, or other source, so that in conjunction with the automatic pump the total number of heads noted in Table 76.25–15 (a) may be operated with the same efficiency as noted above, and at the same time to deliver water from the two highest fire hose outlets in a manner similar to that described in § 76.10–5 (c). Intermediate values may be obtained by interpolation.

TABLE 76.25–15 (a)

| Maximum number of heads on one deck in one zone | Number of heads automatic pump to supply | Number of heads additional pumps to supply |
|---|---|---|
| 5 | 5 | ---------- |
| 10 | 10 | ---------- |
| 20 | 10 | 10 |
| 30 | 12 | 16 |
| 40 | 15 | 18 |
| [illegible] | 15 | 25 |
| 60 | 20 | 25 |
| 80 | [illegible] | [illegible] |
| 100 | [illegible] | 40 |
| 120 | 20 | 50 |
| 150 | [illegible] | 60 |
| [illegible] | 20 | 75 |
| 250 | 20 | 100 |

**§ 76.25–20 Pressure tank.**

(a) A pressure tank or other suitable means shall be installed to permit early action of the system pending the starting of the pump. Sufficient fresh water shall be carried in the tank to fill the piping of the largest zone, and in addition, force out at least 200 gallons at the least effective head in the zone at a Pitot tube pressure of at least 15 p.s.i. Suitable check valves shall be installed to prevent salt water from entering the pressure tank, and low water and low pressure alarms shall be fitted.

**§ 76.25–25 Controls.**

(a) The controls for the system shall be outside the spaces protected, and shall not be located in such space as might be cut off or made inaccessible in the event of fire in any of the spaces protected. The control space shall be marked as required by § 78.47–17 of this subchapter.

(b) Each supply line to the various zones shall be fitted with a stop valve which shall be marked as required by § 78.47–15 of this subchapter. These valves shall be normally open, and shall indicate by an alarm if they are closed.

**§ 76.25–30 Piping.**

(a) All piping, valves, and fittings of ferrous materials shall be protected in-

side and outside against corrosion unless specifically approved by the Commandant.

(b) All piping, valves, fittings, and sprinkler heads shall be securely supported, and, where necessary, protected against injury.

(c) Drains and dirt traps shall be fitted where necessary to prevent the accumulation of dirt or moisture.

(d) Piping shall be used for no other purpose.

**§ 76.25–35 Operation and installation.**

(a) The system shall be so arranged and installed that a fire in any of the protected spaces will open the affected sprinkler heads. Water from the pressure tank shall be immediately available to the affected sprinkler head and before the supply from the pressure tank is exhausted, the sprinkler pump shall be automatically started and shall supply the system until manually shut off. Suitable test stations shall be installed in each zone to test the operation of the system.

(b) The system shall be so arranged and installed that the presence of a fire in any of the protected spaces will automatically be registered visibly and audibly in the pilothouse or fire control station. The visible notice shall automatically indicate the zone in which the alarm originated. On vessels over 150 feet in length, there shall also be an audible alarm in the engine room.

(c) There shall be not less than two sources of power supply for the sea water pumps, air compressors and automatic alarms. Where the sources of power are electrical, these shall be a main generator and an emergency source of power. One supply shall be taken from the main switchboard, by separate feeders reserved solely for that purpose. Such feeders shall be run to a change-over switch situated near to the sprinkler unit and the switch shall normally be kept closed to the feeder from the emergency switchboard. The change-over switch shall be clearly labeled and no other switch shall be permitted in these feeders.

(d) Where subject to freezing, sprinkler systems shall be of the dry pipe type.

(e) The sprinkler heads, the cabinet, alarms, dry valves and actuating mechanisms shall be of an approved type.

(f) In general, the sprinkler heads shall be rated not lower than 135 degrees F. nor higher than 165 degrees F. However, in spaces where a high ambient temperature may be expected, sprinkler heads rated at 212 degrees F. shall be used.

(g) The automatic sprinkling system and all its components shall be used for no other purpose.

(h) All wiring and electrical circuits and equipment shall meet the applicable requirements of Subchapter J (Electrical Engineering) of this chapter.

(i) All piping, valves, fittings, pressure tanks, etc., shall meet the applicable requirements of Subchapter F (Marine Engineering) of this chapter.

(j) A framed chart or diagram shall be installed in the wheelhouse or control station adjacent to the detecting cabinet indicating the location of the various detecting zones and giving instructions for the operation, maintenance, and testing of the system. This chart, or a separate card or booklet to be kept near the chart, shall have tabulated spaces for the date and signature of the licensed officer of the vessel who shall witness or conduct the periodic tests.

(k) The audible alarms shall be identified as required by § 78.47–13 of this subchapter.

**§ 76.25–90 Installations contracted for prior to November 19, 1952.**

(a) Installations contracted for prior to November 19, 1952, shall meet the following requirements:

(1) Existing arrangements, materials, and facilities previously approved shall be considered satisfactory so long as they meet the minimum requirements of this paragraph, and they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and replacements may be made to the same standards as the original installation.

(2) The details of the system shall be in general agreement with §§ 76.25–5 through 76.25–35 insofar as is reasonable and practicable. Existing piping, pumping facilities, sprinkler heads, and operating devices may be retained provided a reasonable coverage of the spaces protected is assured.

## Subpart 76.27—Electric Fire Detecting System, Details

**§ 76.27–1 Application.**

(a) Where an electric fire detecting system is installed, the provisions of this subpart, with the exception of § 76.27–90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of § 76.27–90.

**§ 76.27–5 Zoning.**

(a) The fire detecting system shall be divided into separate zones to restrict the area covered by any particular alarm signal.

(b) All spaces in a fire detecting zone shall be accessible from one to another without leaving the deck involved. All doors in watertight subdivision bulkheads and main vertical zone bulkheads shall be assumed closed for the purpose of this requirement.

(c) The fire detecting zone shall not include spaces on more than one deck, except:

(1) Adjacent and communicating spaces on different decks in the ends of the vessel having a combined ceiling area of not more than 3,000 square feet.

(2) Isolated rooms or lockers in such spaces as mast houses, wheelhouse top, etc., which are easily communicable with the area of the fire-detecting circuit to which they are connected.

(3) Systems with indicators for individual spaces.

(d) The fire detecting zone shall not contain more than 50 protected rooms or spaces.

**§ 76.27–10 Location and spacing of detectors.**

(a) The detectors shall be located close to the overhead in the space protected. Where liable to physical damage, the detector shall be suitably protected.

(b) Unless specifically approved otherwise, no spot on the overhead of a protected space shall be more than 10 feet from a detector. Where beams or girders extend below the ceiling, or where the ceiling is installed at more than one level, the detectors shall be so located as to be most effective.

**§ 76.27–15 Operation and installation.**

(a) The system shall be so arranged and installed that the presence of a fire in any of the protected spaces will be automatically registered visibly and audibly in the pilothouse or fire control station. The visible notice shall indicate the zone in which the alarm originated. On vessels over 150 feet in length, there shall also be an audible alarm in the engine room.

(b) The detectors, the detecting cabinet and alarms shall be of an approved type.

(c) In general, the detectors, shall be rated not lower than 135 degrees F. and not higher than 165 degrees F. However, in spaces where a high ambient temperature may be expected, detectors shall be rated not lower than 175 degrees F. and not higher than 225 degrees F.

(d) The fire detecting system shall be used for no other purpose, except that it may be incorporated with the manual alarm system.

(e) All wiring and electrical circuits and equipment shall meet the applicable requirements of Subchapter J (Electrical Engineering) of this chapter.

(f) A framed chart or diagram shall be installed in the wheelhouse or control station adjacent to the detecting cabinet indicating the location of the various detecting zones and giving instructions for the operation, maintenance, and testing of the system. This chart, or a separate card or booklet to be kept near the chart, shall have tabulated spaces for the date and signature of the licensed officer of the vessel who shall witness or conduct the periodic tests.

(g) The audible alarms shall be identified as required by § 78.47–13 of this subchapter.

**§ 76.27–90 Installations contracted for prior to November 19, 1952.**

(a) Installations contracted for prior to November 19, 1952, shall meet the following requirements:

(1) Existing arrangements, materials, and equipment previously approved shall be considered satisfactory so long as they meet the minimum requirements of this paragraph, and they are maintained in good condition to the satisfaction of the Officer in Charge, Marine

Inspection. Minor repairs and alterations may be made to the same standards as the original installation.

(2) The details of the systems shall be in general agreement with §§ 76.27–5 through 76.27–15 insofar as is reasonable and practicable.

## Subpart 76.30—Pneumatic Fire Detecting System, Details

### § 76.30–1 Application.

(a) Where a pneumatic fire detecting system is installed, the provisions of this subpart, with the exception of § 76.30–90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of § 76.30–90.

### § 76.30–5 Zoning.

(a) The fire detecting system shall be divided into separate zones to restrict the area covered by any particular alarm signal.

(b) All spaces in a fire detecting zone shall be accessible from one to another without leaving the deck involved. All doors in watertight subdivision bulkheads and main vertical zone bulkheads shall be assumed closed for the purpose of this requirement.

(c) The fire detecting zone shall not include spaces on more than one deck, except:

(1) Adjacent and communicating spaces on different decks in the ends of the vessel, having a combined deck area of not more than 3,000 feet.

(2) Isolated rooms or lockers in such spaces as mast houses, wheelhouse top, etc., which are easily communicable with the area of the fire-detecting circuit to which they are connected.

(d) The fire detecting zone shall not include more than 50 protected rooms or spaces.

(e) Individual tubing circuits shall not contain more than 1,000 feet of pneumatic tubing or its equivalent. However, more than one tubing circuit may be included in the same fire detecting zone.

### § 76.30–10 Location and spacing of tubing.

(a) The tubing shall be located on the overhead or within 12 inches of the overhead on the bulkheads. Where liable to physical damage, the tubing shall be suitably protected.

(b) In each enclosed space or separate room there shall be exposed at least 5 percent of the total length of tubing in that circuit, but in no case shall the amount be less than 25 feet.

(c) No spot on the overhead of a protected space shall be more than 12 feet from the nearest point of tubing. Where beams or girders extend below the ceiling, or where the ceiling is installed at more than one level, the tubing shall be so located as to be most effective.

### § 76.30–15 Operation and installation.

(a) The system shall be so arranged and installed that the presence of a fire in any of the protected spaces will automatically be registered visibly and audibly in the pilothouse or fire control station. The visible notice shall automatically indicate the zone in which the alarm originated. On vessels over 150 feet in length, there shall also be an audible alarm in the engine room.

(b) The tubing or detecting devices, pneumatic-electric converting units, detecting cabinets, and alarms shall be of an approved type.

(c) In general, the system shall be adjusted to operate at a temperature rise of approximately 40 degrees F. per minute at the center of the circuit.

(d) The fire detecting system shall be used for no other purpose except that it may be incorporated with the manual alarm system.

(e) All wiring and electrical circuits and equipment shall meet the applicable requirements of Subchapter J (Electrical Engineering) of this chapter.

(f) A framed chart or diagram shall be installed in the wheelhouse or control station adjacent to the detecting cabinet indicating the location of the various detecting zones and giving instructions for the operation, maintenance, and testing of the system. This chart, or a separate card or booklet to be kept near the chart, shall have tabulated spaces for the date and signature of the licensed officer of the vessel who shall witness or conduct the periodic tests.

(g) The audible alarms shall be identified as required by § 78.47–13 of this subchapter.

### § 76.30–90 Installations contracted for prior to November 19, 1952.

(a) Installations contracted for prior to November 19, 1952, shall meet the following requirements:

(1) Existing arrangements, materials, and equipment previously approved shall be considered satisfactory so long as they meet the minimum requirements of this paragraph and they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standards as the original installation.

(2) The details of the systems shall be in general agreement with §§ 76.30–5 through 76.30–15 insofar as is reasonable and practicable.

## Subpart 76.33—Smoke Detecting System, Details

### § 76.33–1 Application.

(a) Where a smoke detecting system is installed, the provisions of this subpart, with the exception of § 76.33–90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of § 76.33–90.

### § 76.33–5 Zoning.

(a) The smoke detecting system shall be divided into separate zones to restrict the area covered by any particular alarm signal.

(b) The smoke detecting zone shall not include spaces on more than one deck, except the small adjacent spaces mentioned in paragraph (c) of this section.

(c) Each separate space shall be considered as a zone, except that two or three small adjacent spaces having a combined volume not exceeding 5,000 cubic feet may be connected on the same zone.

(d) Where a space is of such size that one accumulator is not sufficient, not more than two accumulators may be combined in one zone.

### § 76.33–10 Location and spacing of accumulators.

(a) Smoke accumulators shall be located overhead in each compartment. Where liable to physical damage, the accumulators and piping shall be suitably protected.

(b) No spot on the overhead of a protected space shall be more than 40 feet from an accumulator.

(c) Accumulators shall not be located closer to the opening of a ventilator than three times the diameter or equivalent diameter of the opening.

### § 76.33–15 Piping.

(a) Individual pipes shall be not less than ¾-inch standard pipe size.

(b) All piping, valves, and fittings of ferrous materials shall be protected inside and outside against corrosion unless specifically approved otherwise by the Commandant.

(c) Where a smoke detecting system serves a space used alternately for liquid and dry cargo, a valve shall be installed between the tank and the detecting cabinet so that the line may be shut off when liquids are carried. When the smoke detecting system is combined with a fire extinguishing system, the operation of the valve shall not affect the operation of the fire extinguishing system.

(d) All piping, valves, and fittings shall be securely supported, and where necessary, protected against injury. The piping shall be installed with as easy bends as practicable, and shall be installed to grade to low points for drainage.

(e) Drains and dirt traps shall be fitted where necessary to prevent the accumulation of dirt or moisture.

### § 76.33–20 Operation and installation.

(a) The system shall be so arranged and installed that the presence of smoke in any of the protected spaces will automatically be indicated visually to an observer directly in front of the detecting cabinet. The visible notice shall automatically indicate the zone in which the smoke originated. The detecting cabinet shall normally be located in the pilothouse or fire control station. On vessels over 5,000 gross tons, there shall also be an automatic audible alarm in the wheelhouse together with an auxiliary audible alarm in the engine room.

(b) If the detecting cabinet is not located in the pilothouse or fire control station, it shall be located in convenient proximity to the valve control station of the extinguishing system. In this case, there shall be in the pilothouse or

fire control station automatic visual alarms, one for each zone in which an alarm may originate, as well as an automatic audible alarm. There shall also be an auxiliary audible alarm in the engine room. For installations contracted for on or after January 1, 1962, where detecting cabinets are not located in the pilothouse or an adjacent fire control station having direct access to the pilothouse, an efficient means of direct communication shall be provided between the pilothouse and the stations where the detecting cabinets are located.

(c) A sufficient quantity of exhaust from the detecting cabinet shall be discharged in the vicinity of the cabinet to permit the detection of fire by odor. A valve shall be installed in such space to direct the exhaust, if obnoxious, to the outside.

(d) The smoke detecting system shall be used for no other purpose except that it may be incorporated with the fire extinguishing system to the spaces covered by the smoke detecting system.

(e) The accumulators, detecting cabinet, interconnecting valves with the fire extinguishing system, alarms, and indicating devices shall be of an approved type.

(f) All wiring and electrical circuits and equipment shall meet the applicable requirements of Subchapter J (Electrical Engineering) of this chapter.

(g) A framed chart or diagram shall be installed adjacent to the detecting cabinet and auxiliary panel indicating the location of the various zones and giving instructions for the operation, maintenance, and testing of the system. The chart at the cabinet location or a separate card or booklet to be kept near the chart, shall have tabulated spaces for the date and signature of the licensed officer of the vessel who shall witness or conduct the periodic tests.

(h) The audible smoke detecting alarms shall be identified as required by § 78.47–13 of this subchapter.

### § 76.33–90 Installations contracted for prior to November 19, 1952.

(a) Installations contracted for prior to November 19, 1952, shall meet the following requirements:

(1) Existing arrangements, material, and equipment previously approved shall be considered satisfactory so long as they meet the minimum requirements of this paragraph and they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standards as the original installation.

(2) The details of the systems shall be in general agreement with §§ 76.33–5 through 76.33–15 insofar as is reasonable and practicable.

## Subpart 76.35—Manual Alarm System, Details

### § 76.35–1 Application.

(a) Where a manual alarm system is installed, the provisions of this subpart, with the exception of § 76.35–90, shall apply to all installations contracted for on or after November 19, 1952. Installations contracted for prior to November 19, 1952, shall meet the requirements of § 76.35–90.

### § 76.35–5 Zoning.

(a) The zoning of the manual alarm system shall meet the same requirements as for the electric fire detecting system, § 76.27–5.

### § 76.35–10 Location and spacing of manual alarm boxes.

(a) There shall be at least one manual alarm box in each zone.

(b) Manual alarms shall be located in main passageways, stairway enclosures, public spaces, or similar locations where they will be readily available and easily seen in case of need.

(c) In general, a sufficient number of manual alarm boxes shall be employed that a person escaping from any space would find a manual alarm box convenient on his normal route of escape.

### § 76.35–15 Operation and installation.

(a) The system shall be so arranged and installed that the presence of a fire may be reported from any of the protected spaces and be automatically registered visibly and audibly in the pilothouse or fire control station. The visible notice shall indicate the zone in which the alarm originated. There shall also be an audible alarm in the engine room.

(b) The manual alarm boxes, cabinet, and alarms shall be of an approved type.

(c) The manual alarm system shall be used for no other purpose, except that it may be incorporated with the fire detecting system.

(d) All wiring and electrical circuits and equipment shall meet the applicable requirements of Subchapter J (Electrical Engineering) of this chapter.

(e) A framed chart or diagram shall be installed in the wheelhouse or control station adjacent to the detecting cabinet indicating the location of the various detecting zones and giving instructions for the operation, maintenance, and testing of the system. This chart, or a separate booklet to be kept near the chart, shall have tabulated spaces for the date and signature of the licensed officer of the vessel who shall witness or conduct the periodic tests.

(f) The manual alarm boxes and bells shall be identified as required by § 78.47–10 of this subchapter.

### § 76.35–90 Installations contracted for prior to November 19, 1952.

(a) Installations contracted for prior to November 19, 1952, shall meet the following requirements:

(1) Existing arrangements, materials, and equipment previously approved shall be considered satisfactory so long as they meet the minimum requirements of this paragraph, and they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. Minor repairs and alterations may be made to the same standards as the original installation.

(2) The details of the systems shall be in general agreement with §§ 76.35–5 through 76.35–15 insofar as is reasonable and practicable.

## Subpart 76.50—Hand Portable Fire Extinguishers and Semiportable Fire Extinguishing Systems, Arrangements, and Details

### § 76.50–1 Application.

(a) The provisions of this subpart, with the exception of § 76.50–90, shall apply to all vessels contracted for on or after November 19, 1952. Vessels contracted for prior to November 19, 1952, shall meet the requirements of § 76.50–90.

### § 76.50–5 Classification.

(a) Hand portable fire extinguishers and semiportable fire extinguishing systems shall be classified by a combination letter and number symbol, the letter indicating the type of fire which the unit could be expected to extinguish, and the number indicating the relative size of the unit.

(b) The types of fire will be designated as follows:

(1) "A" for fires in ordinary combustible materials where the quenching and cooling effects of quantities of water, or solutions containing large percentages of water, are of first importance.

(2) "B" for fires in flammable liquids, greases, etc., where a blanketing effect is essential.

(3) "C" for fires in electrical equipment where the use of nonconducting extinguishing agent is of first importance.

(c) The number designations for size will start with "I" for the smallest to "V" for the largest. Sizes I and II are considered hand portable fire extinguishers and sizes III, IV and V are considered semiportable fire extinguishing systems which shall be fitted with suitable hose and nozzle or other practicable means so that all portions of the space concerned may be covered. Examples of size graduations for some of the typical hand portable and semiportable fire extinguishing systems are set forth in Table 76.50–5 (c).

TABLE 76.50–5 (c)

| Classification | | Soda-acid and water, gallons | Foam, gallons | Carbon dioxide, pounds | Dry chemical, pounds |
|---|---|---|---|---|---|
| Type | Size | | | | |
| A | II | 2½ | 2½ | | |
| B | I | | 1¼ | 4 | 2 |
| B | II | | 2½ | 15 | 10 |
| B | III | | 12 | 35 | 20 |
| B | IV | | 20 | 50 | 30 |
| B | V | | 40 | 100 | 50 |
| C | I | | | 4 | 2 |
| C | II | | | 15 | 10 |

(d) All hand portable fire extinguishers and semiportable fire extinguishing systems shall have permanently attached thereto a metallic name plate giving the name of the item, the rated capacity in gallons, quarts, or pounds, the name and address of the person or firm for whom approved, and the identifying mark of the actual manufacturer.

(e) Vaporizing-liquid type fire extinguishers, containing carbon tetrachloride or chlorobromomethane or other toxic vaporizing liquids shall be removed from all vessels.

### § 76.50–10 Location.

(a) Approved hand portable fire extinguishers and semiportable fire extinguishing systems shall be installed in accordance with Table 76.50–10 (a). The location of the equipment shall be to the satisfaction of the Officer in Charge, Marine Inspection. Nothing in this paragraph shall be construed as limiting the Officer in Charge, Marine Inspection, from requiring such additional equipment as he deems necessary for the proper protection of the vessel.

(b) Semiportable fire extinguishing systems shall be located in the open so as to be readily seen.

(c) If hand portable fire extinguishers are not located in the open or behind glass so that they may be readily seen, they may be placed in enclosures together with the fire hose, provided such enclosures are marked as required by § 78.47–20 of this subchapter.

(d) Hand portable fire extinguishers and their stations shall be numbered in accordance with § 78.47–30 of this subchapter.

(e) Hand portable or semiportable extinguishers, which are required on their nameplates to be protected from freezing, shall not be located where freezing temperatures may be expected.

TABLE 76.50–10 (a)

| Space | Hand portable fire extinguisher and semiportable fire extinguishing systems | |
|---|---|---|
| | Classification (see § 76.50–5) | Quantity and location |
| *Safety areas* [1] | | |
| Wheelhouse or fire control room | A–II, B–II, C–II. | 1 of each classification on vessels over 1,000 gross tons. (Not required in both spaces.) (Multiple classification may be recognized.) |
| Stairway and elevator enclosures | | None required. |
| Communicating corridors | A–II | 1 in each main corridor in each main vertical zone. (May be located in stairway enclosures.) |
| Lifeboat embarkation and lowering stations | | None required. |
| Radio room | C–I [2] | 2 in vicinity of exit.[3] |
| *Accommodations* [1] | | |
| Staterooms, toilet spaces, isolated pantries, etc. | | None required. |
| Offices, lockers, and isolated storerooms | | Do. |
| Public spaces | A–II | 1 for each 2,500 square feet or fraction thereof located in vicinity of exits, except that none required for spaces under 500 square feet. |
| Open decks or enclosed promenades | | None required. |
| *Service spaces* | | |
| Galleys | B–II or C–II. | 1 for each 2,500 square feet or fraction thereof suitable for hazards involved. |
| Main pantries | A–II | 1 for each 2,500 square feet or fraction thereof located in vicinity of exits. |
| Motion picture booths and film lockers | C–I [2] | 1 outside in vicinity of exit. |
| Paint and lamp rooms | B–II | 1 outside space in vicinity of exit. |
| Inaccessible baggage, mail, and specie rooms, and storerooms. | | None required. |
| Accessible baggage, mail, and specie rooms, and storerooms. | A–II | 1 for each 2,500 square feet or fraction thereof located in vicinity of exits, either inside or outside the spaces. |
| Refrigerated storerooms | A–II | 1 for each 2,500 square feet or fraction thereof located in vicinity of exits, outside the spaces. |
| Carpenter, valet, photographic, printing shops sales rooms, etc. | A–II | 1 outside the space in vicinity of exit. |
| *Machinery spaces* | | |
| Coal Fired Boilers: Bunker and boilerspace | | None required. |
| Oil Fired Boilers: Spaces, containing oil fired boilers, either main or auxiliary, or their fuel oil units. | B–II<br>B–V | 2 required.[5]<br>1 required.[4] |
| Internal combustion or gas turbine propelling machinery spaces. | B–II<br>B–III | 1 for each 1,000 B. H. P., but not less than 2 or more than 6.<br>1 required.[3] |
| Electric propulsive motors or generators of open type. | C–II | 1 for each propulsion motor or generator unit. |
| Enclosed ventilating systems for motors and generators of electric propelling machinery. | | None required. |
| Auxiliary spaces, internal combustion or gas turbine. | B–II | 1 outside the space in vicinity of exit. |
| Auxiliary spaces, electric emergency motors or generators. | C–II | Do. |
| Auxiliary spaces, steam | | None required. |
| Trunks to machinery spaces | | Do. |
| Fuel tanks | | Do. |
| *Cargo spaces* | | |
| Inaccessible during voyage, including trunks (excluding tanks). | | Do. |
| Accessible during voyage | A–II | 1 for each 1,200 square feet or fraction thereof. |
| Vehicular spaces (covered by sprinkler system). | B–II | 1, plus 1 for each 5,000 square feet or fraction thereof. |
| Vehicular spaces (not covered by sprinkler system). | B–II | 1, plus 1 for each 1,500 square feet or fraction thereof.[7] |
| Cargo oil tanks | | None required. |

[1] In any case, on vessels of 180 feet in length, and over, there shall be at least 2 A–II units on each passenger deck.
[2] For vessels on an international voyage, substitute 1 C–II in vicinity of exit.
[3] Vessels of less than 1,000 gross tons and not on an international voyage, require 1.
[4] Vessels of less than 1,000 gross tons and not on an international voyage may substitute 1 B–IV.
[5] If oil burning donkey boiler fitted in space, the B–V previously required for the protection of the boilerroom may be substituted. Not required on vessels of less than 300 gross tons if fuel has flashpoint of 110° F. or lower except those on an international voyage.
[6] Not required on vessels of less than 300 gross tons if fuel has flash point higher than 110° F.
[7] 2 B–I units may be substituted for 1 B–II unit.

### § 76.50–15 Spare charges.

(a) Spare charges shall be carried on all vessels for at least 50 percent of each size and each variety, i.e., foam, soda-acid, carbon dioxide, etc., of hand portable fire extinguisher required by §76.50–10(a). However, if the unit is of such variety that it cannot be readily recharged by the vessel's personnel, one spare unit of the same classification shall be carried in lieu of spare charges for all such units of the same size and variety.

(b) Spare charges shall be so packaged as to minimize the hazards to personnel while recharging the units. Acid shall be contained in a Crown stopper type of bottle.

### § 76.50–90 Vessels contracted for prior to November 19, 1952.

(a) Vessels contracted for prior to November 19, 1952, shall meet the following requirements:

(1) The provisions of §§ 76.50–5 through 76.50–15 shall be met with the exception that existing installations in safety areas, accommodations, service spaces, and cargo spaces may be maintained if in the opinion of the Officer in Charge, Marine Inspection, they are in general agreement with the standard of safety prescribed by Table 76.50–10 (a). In such cases, minor modifications may be made to the same standards as the original installation, provided that in no case will a greater departure from the standards of Table 76.50–10(a) be permitted than presently exists.

## Subpart 76.60—Fire Axes

### § 76.60–1 Application.

(a) The provisions of this subpart shall apply to all vessels.

### § 76.60–5 Number required.

(a) All vessels except barges shall carry at least the minimum number of fire axes as set forth in Table 76.60–5(a). Nothing in this paragraph shall be construed as limiting the Officer in Charge, Marine Inspection, from requiring such additional fire axes as he deems necessary for the proper protection of the vessel.

TABLE 76.60–5 (a)

| Gross tons | | Number of axes |
|---|---|---|
| Over | Not over | |
| --- | 50 | 1 |
| 50 | 200 | 2 |
| 200 | 500 | 4 |
| 500 | 1,000 | 6 |
| 1,000 | --- | 8 |

(b) Covered barges shall carry at least three fire axes and uncovered barges shall carry at least two fire axes.

### § 76.60–10 Location.

(a) Fire axes shall be distributed throughout the spaces available to passengers and crew so as to be most readily available in the event of emergency.

(b) If fire axes are not located in the open or behind glass so that they may be

readily seen, they may be placed in enclosures together with the fire hose, provided such enclosures are marked as required by § 78.47-20 of this subchapter.

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# PART 77—VESSEL CONTROL AND MISCELLANEOUS SYSTEMS AND EQUIPMENT


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Subpart 77.35—Fireman's Outfit

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77.35-10 Fireman's outfit.
77.35-15 Stowage.
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77.35-90 Vessels contracted for prior to May 26, 1965.


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## Subpart 77.01—Application

### § 77.01-1 General.

(a) The provisions of this part shall apply to all vessels except as specifically noted.

## Subpart 77.03—Marine Engineering Systems

### § 77.03-1 Installation and details.

(a) The installation of all systems of a marine engineering nature, together with the details of design, construction, and installation, shall be in accordance with the requirements of Subchapter F (Marine Engineering) of this chapter. Systems of this type include the following:

Steering systems.
Power for going astern.
Bilge and ballast systems.
Tank vent and sounding systems.
Overboard discharges and shell connections.
Pipe and pressure systems.

## Subpart 77.05—Electrical Engineering and Interior Communication Systems

### § 77.05-1 Installation and details.

(a) The installation of all systems of an electrical engineering or interior communications nature, together with the details of design, construction, and installation, shall be in accordance with the requirements of Subchapter J (Electrical Engineering) of this chapter. Systems of this type include the following:

Ship's service lighting and power systems.
Emergency lighting and power systems.
General alarm systems.
Sound powered telephone and voice tube communication systems.
Engine order telegraph systems.
Rudder angle indicator systems.
Emergency loudspeaker systems.
Refrigerated spaces alarm systems.
Miscellaneous machine alarms and controls.
Daylight signaling lamps.

## Subpart 77.07—Anchors, Chains, and Hawsers

### § 77.07-1 Application.

(a) The provisions of this subpart, with the exception of § 77.07-90, shall apply to all vessels contracted for on or after November 19, 1952. Vessels contracted for prior to November 19, 1952, shall meet the requirements of § 77.07-90.

### § 77.07-5 Ocean, coastwise, or Great Lakes service.

(a) Vessels in ocean, coastwise, or Great Lakes service shall be fitted with anchors, chains, and hawsers in general agreement with the standards established by the American Bureau of Shipping, see Subpart 70.35 of this subchapter.

### § 77.07-10 Lakes, bays, and sounds, or river service.

(a) Vessels in lakes, bays, and sounds, or river service shall be fitted with such ground tackle and hawsers as deemed necessary by the Officer in Charge, Marine Inspection, depending upon the size of the vessel and the waters on which it operates.

### § 77.07-90 Vessels contracted for prior to November 19, 1952.

(a) Vessels contracted for prior to November 19, 1952, shall meet the following requirements:

(1) Installations previously accepted or approved shall be considered satisfactory for the same service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection. If the service of the vessel is changed, the suitability of the equipment will be established by the Officer in Charge, Marine Inspection.

## Subpart 77.13—Radiotelegraph and Radiotelephone

### § 77.13-1 Required by Federal Communications Commission.

(a) Radiotelegraph and radiotelephone installations are required on certain vessels. Details of the application of this requirement as well as details of the installation shall be as required by the statutes and regulations under the jurisdiction of the Federal Communications Commission.

## Subpart 77.15—Radio Direction Finder

### § 77.15-1 Application.

(a) The provisions of this subpart, with the exception of § 77.15-90, shall apply to all mechanically propelled vessels of 1,600 gross tons and over in ocean service or on an international voyage contracted for on or after November 19, 1952. Such vessels contracted for prior to November 19, 1952, shall meet the requirements of § 77.15-90.

### § 77.15-5 Required by Federal Communications Commission.

(a) All vessels shall be fitted with a radio direction finder. Details of the installation shall be as required by the statutes and regulations under the jurisdiction of the Federal Communications Commission.

### § 77.15-90 Vessels contracted for prior to November 19, 1952.

(a) Vessels contracted for prior to November 19, 1952, shall meet the following requirements:

(1) Vessels of over 5,000 gross tons shall meet the requirements of § 77.15-5.

(2) Vessels of from 1,600 gross tons through 5,000 gross tons shall meet the requirements of § 77.15-5 on or before November 19, 1954.

## Subpart 77.17—Navigation Lights and Shapes

### § 77.17–1 When required.

(a) All vessels shall be equipped with navigation lights and shapes as prescribed by law and regulation.

## Subpart 77.20—Whistles

### § 77.20–1 Vessels other than sailing vessels and barges.

(a) All vessels other than sailing vessels and barges shall be equipped with an efficient whistle or similar appliance to give the necessary whistle signals required by the Rules of the Road applicable to the waters on which the vessel is navigated. The location of the whistle and operating devices shall be as follows:

(1) Means shall be provided to operate the whistle or other appliance from a position adjacent to the main steering station and from the steering station on top of the wheelhouse where such steering station is fitted. Details of the whistle operating device shall be as described in Subchapter J (Electrical Engineering) of this chapter.

(2) In general, the whistle shall be located on the forward side of or above the structure of the vessel so as to be as free of obstructions as possible. Where practicable, it shall be installed at least 6 feet above the wheelhouse, except that on vessels navigating the Western Rivers, and any vessel of less than 100 gross tons, it shall be at least 2 feet above the wheelhouse.

(3) On double ended ferry vessels and similar vessels, where steam whistles are employed, they shall be installed both forward and aft of the stacks or one such whistle on either the port or starboard side of the stack.

## Subpart 77.23—Foghorns

### § 77.23–1 When required.

(a) Vessels shall be equipped with an efficient foghorn as prescribed by the Rules of the Road for the waters on which the vessel is navigated. On vessels in ocean or coastwise service, the fog horn shall be sounded by mechanical means.

## Subpart 77.25—Fog Sound Signal Devices

### § 77.25–1 When required.

(a) All vessels shall be provided with an efficient fog bell at least 8 inches in diameter. The fog bell shall be located where the sound will be least obstructed.

(b) All vessels of more than 350 feet in length shall be provided with a fog gong which will produce a sound easily distinguishable from the sound of the bell required by paragraph (a) of this section and shall have a range of audibility approximating that of the bell. Vessels operating exclusively on the Great Lakes and the inland waters of the United States shall be exempt from this paragraph.

## Subpart 77.27—Sounding Equipment

### § 77.27–1 When required.

(a) All mechanically propelled vessels in ocean or coastwise service of 500 gross tons and over, and all mechanically propelled vessels in Great Lakes service of 1,500 gross tons and over, except paddle wheel vessels, shall be fitted with an efficient mechanical or electronic deep-sea sounding apparatus in addition to the deep-sea hand leads. On Great Lakes vessels, a shallow water alarm may be substituted.

## Subpart 77.30—Emergency Equipment

### § 77.30–1 Application.

(a) The provisions of this subpart, with the exception of § 77.30–90, shall apply to all vessels not on an international voyage contracted for on or after November 19, 1952. Such vessels contracted for prior to November 19, 1952, shall meet the requirements of § 77.30–90.

### § 77.30–5 General.

(a) All self-contained breathing apparatus and gas masks shall be of an approved type, constructed in accordance with Subpart 160.011 of Subchapter Q (Specifications) of this chapter.

(b) All gas masks, except the special refrigeration gas masks, shall be of the type approved by the Bureau of Mines as "Type N, Universal Gas Mask".

(c) All flame safety lamps shall be of an approved type, constructed in accordance with Subpart 160.016 of Subchapter Q (Specifications) of this chapter.

(d) All emergency equipment shall be maintained in an operative condition, and it shall be the responsibility of the master and chief engineer to ascertain that a sufficient number of the crew are familiar with the operation of the equipment.

### § 77.30–10 Stowage.

(a) The equipment set forth in Table 77.30–10 (a), together with such other items as the master may deem necessary, shall be stowed in convenient, accessible locations for use in case of emergency.

(b) The refrigeration gas masks shall be stowed convenient to, but outside of the spaces containing the refrigeration equipment.

(c) Half of the remaining equipment set forth in Table 77.30–10 (a) shall be stowed in or near the pilothouse together with a fire axe and the hand portable fire extinguishers required by Table 76.50–10 (a) for that location. The other half of the equipment shall be stowed in a convenient accessible location, remote from the pilothouse, and preferably adjacent to the main entrance to the machinery space. Where only one of an item is required, it shall be stowed in the pilothouse.

TABLE 77.30-10(a)

| Service | Number of [illegible] staterooms | Self-contained breathing apparatus | Additional gas masks or self-contained breathing apparatus | Special refrigeration gas masks [1] | Flame safety lamps |
|---|---|---|---|---|---|
| Ocean and coastwise, not on an international voyage. | 0 to 49 | | | 1 | |
| | 50 to 100 | 1 | 3 | 1 | |
| | Over 100 | 1 | 5 | 1 | 1 |
| Great Lakes, and lakes, bays, and sounds. | 0 to 49 | | | 1 | |
| | 50 to 100 | 1 | 1 | 1 | |
| | Over 100 | 1 | 3 | 1 | 1 |
| Rivers | 0 to 49 | | | 1 | |
| | 50 to 100 | 1 | | 1 | |
| | Over 100 | 1 | 1 | 1 | 1 |

[1] Required only on vessels equipped with refrigeration, small unit type refrigerators of not more than 20 cubic feet capacity excluded. A gas mask suitable for protection against each refrigerant used shall be provided.

### § 77.30–15 Spare charges.

(a) A complete recharge shall be carried for each gas mask and self-contained breathing apparatus. The spare charge shall be stowed in the same location as the equipment it is to reactivate.

### § 77.30–90 Vessels contracted for prior to November 19, 1952.

(a) Vessels contracted for prior to November 19, 1952, shall meet the following requirements:

(1) The requirements of §§ 77.30–5 through 77.30–15 shall be complied with insofar as the number of items of equipment and the method of stowage of the equipment is concerned. Existing items of equipment previously approved, but not meeting the applicable specifications set forth in § 77.30–5, may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection, but all new installations or replacements shall meet the applicable specifications or requirements.

## Subpart 77.35—Fireman's Outfit

### § 77.35–1 Application.

(a) The provisions of this subpart, with the exception of § 77.35–90, shall apply to all vessels on an international voyage contracted for on or after May 26, 1965. Such vessels contracted for prior to May 26, 1965, shall meet the requirements of § 77.35–90.

### § 77.35–5 General.

(a) All flame safety lamps shall be of an approved type, constructed in accordance with Subpart 160.016 of Subchapter Q (Specifications) of this chapter.

(b) All self-contained breathing apparatus shall be of an approved type, constructed in accordance with Subpart 160.011 of Subchapter Q (Specifications) of this chapter.

(c) All flashlights shall be of an approved 3-cell explosion-proof type, constructed in accordance with Subpart 161.008 of Subchapter Q (Specifications) of this chapter.

(d) All lifelines shall be of steel or bronze wire rope. Steel wire rope shall be either inherently corrosion resistant, or made so by galvanizing or tinning. Each end shall be fitted with a hook with keeper having throat opening which can be readily slipped over a ⅝-inch bolt. The total length of the lifeline shall be dependent upon the size and arrangement of the vessel, and more than one line may be hooked together to achieve the necessary length. No individual length of lifeline may be less than 50 feet in length. The assembled lifeline shall have a minimum breaking strength of 1,500 pounds.

(e) All equipment shall be maintained in an operative condition, and it shall be the responsibility of the master and chief engineer to ascertain that a sufficient number of the crew are familiar with the operation of the equipment.

**§ 77.35–10 Fireman's outfit.**

(a) A fireman's outfit shall consist of one self-contained breathing apparatus with lifeline attached, one flashlight, one flame safety lamp, and one fire ax.

(b) The number of fireman's outfits required are as set forth in Table 77.35–10(b).

TABLE 77.35-10(b)

| Gross tonnage | | Minimum number of fireman's outfits |
|---|---|---|
| Over— | Not over— | |
| | 10,000 | 2 |
| 10,000 | 20,000 | 3 |
| 20,000 | | 4 |

**§ 77.35–15 Stowage.**

(a) The fireman's outfit, together with such other items of equipment as the master may deem necessary, shall be stowed in convenient, accessible locations for use in case of emergency. One outfit shall be stowed in or near the pilothouse. Where additional outfits are required by Table 77.35–10(b), one of the additional outfits shall be stowed preferably adjacent to the main entrance to the machinery space. Other additional outfits shall be stowed in convenient accessible locations remote from the pilothouse.

**§ 77.35–20 Spare charges.**

(a) A complete recharge shall be carried for each self-contained breathing apparatus, and a complete set of spare batteries shall be carried for each flashlight. The spares shall be stowed in the same location as the equipment it is to reactivate.

**§ 77.35–90 Vessels contracted for prior to May 26, 1965.**

(a) Vessels contracted for prior to May 26, 1965, shall meet the following requirements:

(1) The requirements of §§ 77.35–5 through 77.35–20 shall be complied with insofar as the number of items of equipment and the method of stowage of the equipment is concerned. Existing items of equipment previously approved, but not meeting the applicable specifications set forth in § 77.35–5, may be continued in service so long as they are maintained in good condition to the satisfaction of the Officer in Charge, Marine Inspection, but all new installations or replacements shall meet the applicable specifications or requirements.

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## PART 78—OPERATIONS


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78.25–1 Unauthorized lights prohibited.

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AUTHORITY: The provisions of this Part 78 issued under R.S. 4405, as amended, 4462, as amended; 46 U.S.C. 375, 416. Interpret or apply R.S. 4417, as amended, 4418, as amended, 4426, as amended, 4453, as amended, sec. 10, 35 Stat. 428, as amended, 41 Stat. 305, as amended, secs. 1, 2, 49 Stat. 1544, 1545, as amended, sec. 3, 54 Stat. 347, as amended, sec. 3, 70 Stat. 152, sec. 3, 68 Stat. 675; 46 U.S.C. 391, 392, 404, 435, 395, 363, 367, 1333, 390b, 50 U.S.C. 198; E.O. 11239, July 31, 1965, 30 F.R. 9671, 3 CFR, 1965 Supp. Treasury Department Orders 120, July 31, 1950, 15 F.R. 6521; 167–14, Nov. 26, 1954, 19 F.R. 8026; 167–20, June 18, 1956, CGFR 56–28, July 24, 1956, 21 F.R. 5659, unless otherwise noted.

## Subpart 78.01—Application

### § 78.01–1 General.

(a) The provisions of this part shall apply to all vessels except as specifically noted.

## Subpart 78.03—Penalties

### § 78.03–1 General.

(a) The marine safety and criminal statutes provide penalties for the violation of the applicable provisions of this subchapter, which penalties, depending upon the gravity of the violation, are as follows:

(1) Assessment and collections of civil monetary penalty.

(2) Criminal prosecution where no loss of life results.

(3) Criminal prosecution for manslaughter where loss of life results from violation of statute or regulation or from misconduct, negligence, or inattention to duty.

(4) Libel against vessel.

(b) In addition to the foregoing, any licensed or certificated personnel committing an act of misbehavior, negligence, unskillfulness, endangering life, violation of marine safety statutes or regulations or requirements thereunder, and incompetency shall be subject to proceedings under the provisions of 46 U. S. C. 239 and regulations thereunder (46 CFR Part 137) with respect to suspension or revocation of license or certificate.

## Subpart 78.05—Notice to Mariners and Aids to Navigation

### § 78.05–1 Duty of officers.

(a) Licensed deck officers are required to acquaint themselves with the latest information published by the Coast Guard and the United States Navy regarding aids to navigation. Neglect to do so is evidence of neglect of duty. It is desirable that all vessels have available in the pilothouse for convenient reference at all times a file of the applicable Notice to Mariners.

(1) Notice to Mariners, published weekly by the Coast Guard, contains announcements and information regarding aids to navigation and charts of waters of the United States and is available for free distribution at field offices of the Coast Guard, United States Coast and Geodetic Survey field stations, and the Marine Division, Customhouse.

(2) Notice to Mariners, published weekly by the United States Navy for the correction of charts, sailing directions, light lists, and other publications, and which includes foreign waters and certain waters of the United States, is available for free distribution at the Oceanographic Office, Branch Oceanographic offices, or any of the agencies at seaboard ports, and is also on file in the United States consulates where they may be inspected.

### § 78.05–5 Charts.

(a) All vessels, except barges, ferryboats, and vessels operating exclusively on rivers, shall have charts of the waters upon which they operate available for convenient reference at all times.

## Subpart 78.07—Notice of Casualty and Voyage Records

AUTHORITY: The provisions of this Subpart 78.07 interpret or apply R.S. 4450, as amended, 4488, as amended, secs. 13, 17, 54 Stat. 166, as amended, sec. 10, 18 Stat. 128, as amended; 46 U.S.C. 239, 481, 526 *l*(c), 526p, 33 U.S.C. 361. Treasury Department Orders 167–32, September 23, 1958, 23 F.R. 7605; 167–38, October 26, 1959, 24 F.R. 8857.

### § 78.07–1 Notice of casualty.

(a) The owner, agent, master, or person in charge of a vessel involved in a marine casualty shall give notice as soon as possible to the nearest marine inspection office of the U.S. Coast Guard whenever the casualty results in any of the following:

(1) Damage to property in excess of $1,500.

(2) Material damage affecting the seaworthiness or efficiency of a vessel.

(3) Stranding or grounding.

(4) Loss of life.

(5) Injury causing any person to remain incapacitated for a period in excess of 72 hours; except injury to harbor workers not resulting in death and not resulting from vessel casualty or vessel equipment casualty.

(b) The master of any nuclear vessel shall immediately inform the Commandant in the event of any accident or casualty to the nuclear vessel which may lead to an environmental hazard. The master shall also immediately inform the competent governmental authority of the country in whose waters the vessel may be in, or whose waters the vessel approaches in a damaged condition.

### § 78.07–5 Information required.

(a) The notice required by § 78.07–1 shall show the name and official number of the vessel involved, the owner or agent thereof, the nature and probable occasion of the casualty, the locality in which it occurred, the nature and extent of injury to persons and the damage to property.

### § 78.07–10 Written report.

(a) In addition to the notice required by § 78.07–1, the person in charge of the vessel shall, as soon as possible, report in writing and in person to the Officer in Charge, Marine Inspection, at the port in which the casualty occurred or nearest the port of first arrival. However, if from a distance it may be inconvenient to report in person, it may be done in writing only. The written report required for personal accident shall be made on Form CG–924E and submitted for each individual injured and each loss of life. For all other vessel casualties the written report shall be made on Form CG–2692.

(b) If filed without delay, the Form CG–924E or CG–2692 may also provide the notice required by § 78.07–1.

### § 78.07–15 Retention of records.

(a) The owner, agent, master, or other person in charge of any vessel involved in a marine casualty shall retain such voyage records of the vessel as are maintained by the vessel, such as both rough and smooth deck and engine room logs, bell books, navigation charts, navigation work books, compass deviation cards, gyrocompass records, stowage plans, record of draft, aids to mariners, radiograms sent and received, the radio log and crew and passenger lists. The owner, agent, master, or other officer in charge, shall make these records available to a duly authorized Coast

Guard officer or employee for examination upon request.

**§ 78.07–20 Aids to navigation.**

(a) Whenever a vessel collides with a lightship, buoy, or other aid to navigation under the jurisdiction of the Coast Guard, or is connected with any such collision, it shall be the duty of the person in charge of such vessel to report the accident to the nearest Officer in Charge, Marine Inspection. No report on Form CG–2692 is required unless any of the results listed in § 78.07–1 (a) occur.

**§ 78.07–25 Reports when state of war exists.**

(a) During the period when a state of war exists between the United States and any foreign nation, communications in regard to casualties or accidents shall be handled with caution and the reports shall not be made by radio or by telegram.

## Subpart 78.10—Persons Allowed in Pilothouse and on Navigation Bridge

**§ 78.10–1 Persons excluded.**

(a) Masters and pilots shall exclude from the pilothouse and navigator's bridge while under way, all persons not connected with the navigation of the vessel. However, inspectors of the Coast Guard, licensed officers of vessels, persons regularly engaged in learning the profession of pilot, officers of the Coast Guard, United States Navy, United States Coast and Geodetic Survey, and the Engineer Department of the United States Army or Maritime Administration personnel, may be allowed in the pilothouse or upon the navigator's bridge upon the responsibility of the officer in charge.

## Subpart 78.13—Station Bills

AUTHORITY: The provisions of this Subpart 78.13 interpret or apply R.S. 4488, as amended, 46 U.S.C. 481. Treasury Department Order 167–38, October 26, 1959, 24 F.R. 8857.

**§ 78.13–1 Master's responsibility.**

(a) A station bill (muster list) shall be prepared by the master of the vessel who shall be responsible to sign such station bill and to ascertain that it is duly posted in conspicuous locations in the vessel, particularly in the crew quarters, before the vessel sails.

**§ 78.13–5 Duties of crew.**

(a) The station bill shall set forth the special duties and duty station of each member of the crew for the various emergencies. The duties shall, as far as possible, be comparable with the regular work of the individual. The duties shall in general include the following and, in addition, such other duties shall be assigned as are necessary in the case of the particular vessel for the proper handling of the particular emergency:

(1) The closing of airports, watertight doors, fire doors, scuppers, sanitary and other discharges which lead through the vessel's hull below the margin line, etc., the stopping of fans and ventilating systems, and the operation of all safety equipment.

(2) The preparation and launching of lifeboats, life rafts, and buoyant apparatus.

(3) The extinction of fire.

(4) The muster of passengers which shall in general be assigned to the stewards department, and shall include the following:

(i) Warning the passengers.

(ii) Seeing that they are dressed and have put on their life jackets in a proper manner.

(iii) Assembling the passengers and directing them to the appointed stations.

(iv) Keeping order in the passageways and stairways and generally controlling the movement of the passengers.

(v) Seeing that a supply of blankets is taken to the lifeboats.

(5) The custody of the portable radio apparatus required by Subpart 75.55 of this subchapter.

**§ 78.13–10 Emergency signals.**

(a) *Station bill.* (1) The station bill shall set forth the various signals to be used for the calling of the crew to their stations and for giving instructions while at their stations. These signals shall be as set forth in this section.

(b) *Fire alarm stations.* (1) The fire alarm signal shall be a continuous blast of the whistle for a period of not less than 10 seconds supplemented by the continuous ringing of the general alarm bells for not less than 10 seconds.

(2) For dismissal from fire alarm stations, the general alarm shall be sounded three times supplemented by three short blasts of the whistle.

(c) *Boat stations.* (1) The signal for boat stations or boat drill shall be a succession of more than six short blasts followed by one long blast of the whistle supplemented by a comparable signal on the general alarm bells.

(2) Where whistle signals are used for handling the lifeboats, they shall be as follows:

(i) To lower lifeboats, one short blast.

(ii) To stop lowering the lifeboats, two short blasts.

(3) For dismissal from boat stations, there shall be three short blasts of the whistle.

(d) *River vessels.* (1) In the case of river vessels, the ship's bell may be used in lieu of the whistle signals stipulated in this section.

(e) *Other emergency signals.* (1) The master of any vessel may establish such other emergency signals, in addition to the above, as will provide that all officers, crew, and passengers will have positive and certain notice of the existing emergency.

**§ 78.13–15 Emergency squad.**

(a) Where the size of the crew permits, the station bill shall include an emergency squad which shall be organized by the master to form the nucleus of the damage control party. This squad should be specially trained in the use of all emergency and rescue equipment and should be made generally familiar with the vessel and fundamentals of damage control.

(b) The nature of the signals or other means for assembling the emergency squad shall be left to the discretion of the master, but such signals shall not conflict with navigational or general alarm signals.

**§ 78.13–20 Master to instruct crew.**

(a) The master shall conduct such drills and give such instructions as are necessary to insure that all hands are familiar with their duties as specified in the station bill.

## Subpart 78.14—Manning of Lifeboats and Liferafts

AUTHORITY: The provisions of this Subpart 78.14 interpret or apply R.S. 4488, as amended; 46 U.S.C. 481. Treasury Department Order 167–38, Oct. 26, 1959, 24 F.R. 8857.

**§ 78.14–1 Application.**

(a) The provisions of this subpart shall apply to all vessels.

**§ 78.14–5 Person in command of lifeboat or liferaft.**

(a) For vessels in ocean service, the master shall appoint a first and second in command of each lifeboat and each liferaft who shall be either a licensed deck officer, an able seaman, or a certificated lifeboatman.

(b) For vessels in services, other than ocean service, the master shall appoint a person in command of each lifeboat and each liferaft. Except for vessels in river service, this person shall be either a licensed deck officer, an able seaman or a certificated lifeboatman.

(c) The person in charge of each lifeboat or liferaft shall have a list of its crew, and shall see that the persons under his orders are acquainted with their several duties.

**§ 78.14–10 Certificated lifeboatmen.**

(a) Except for vessels in river service, there shall be for each lifeboat and each liferaft a number of certificated lifeboatmen equal to that specified in Table 78.14–10(a).

TABLE 78.14–10(a)

| Prescribed complement of lifeboat or liferaft | | Minimum number of lifeboatmen | |
|---|---|---|---|
| Over | Not over | Ocean service | All services other than ocean [1] |
| ---- | 25 | 2 | 1 |
| 25 | 40 | 2 | 2 |
| 40 | 60 | 3 | 3 |
| 60 | 85 | 4 | 4 |
| 75 | 110 | 5 | 5 |
| 110 | ---- | 6 | 6 |

[1] Certificated lifeboatmen not required in river service.

(b) The allocation of the certificated lifeboatmen to each lifeboat and each liferaft shall be at the discretion of the master according to circumstances.

**§ 78.14–15 Motor-propelled lifeboat.**

(a) The master shall assign to each motor-propelled lifeboat a man capable of working the motor.

**§ 78.14–20 Lifeboat carrying a wireless or searchlight.**

(a) The master shall assign to each lifeboat carrying wireless and/or searchlight a man capable of operating such equipment.

## Subpart 78.15—Doors Closed at Sea

**§ 78.15–1 Subdivision bulkheads.**

(a) All watertight doors in subdivision bulkheads shall be kept closed during navigation except when necessarily opened for working of the vessel, and in such cases they shall always be ready to be immediately closed.

## Subpart 78.17—Tests, Drills, and Inspections

AUTHORITY: The provisions of this Subpart 78.17 interpret or apply R.S. 4488, as amended; 46 U.S.C. 481. Treasury Department Order 167–38, October 26, 1959, 24 F.R. 8857.

**§ 78.17–1 Application.**

(a) Except as specifically noted, the provisions of this subpart shall apply to all vessels.

**§ 78.17–3 Watertight doors.**

(a) It shall be the duty of the master to see that all watertight doors in subdivision bulkheads that may be opened at sea, and all mechanisms, remote controls, and indicators connected therewith, shall be periodically inspected at least once in each week that the vessel is navigated to be assured that they are in proper operating condition. On vessels in which the voyage exceeds one week in duration, these doors shall be operated before the vessel leaves port. All such doors shall be operated daily.

(b) The date of the test and the condition of the equipment shall be noted in the official log book.

**§ 78.17–5 Valves and closing appliances.**

(a) It shall be the duty of the master to see that all valves, including cross connecting valves where fitted, and other appliances such as port lights, closing mechanism of scuppers, ash chutes, and rubbish chutes, the closing of which is necessary to make a compartment watertight, are operated at least once in every week that the vessel is navigated to be assured that they are in proper operating condition. Any remote controls or indicating mechanisms shall be inspected at this time to test their efficiency. Where such valves are accessible, they shall be inspected at this time, otherwise, they shall be inspected at the first opportunity when they are accessible. On vessels in which the voyage exceeds one week in duration, these appliances shall be operated before the vessel leaves port.

(b) The date of the test and the condition of the equipment shall be noted in the official logbook.

**§ 78.17–10 Loudspeaker system.**

(a) Where fitted, the complete loudspeaker system shall be tested at least once every week. This test shall be made by an officer of the vessel.

(b) The date of the test and the condition of the equipment shall be noted in the official logbook.

CROSS REFERENCE: See § 113.50–35 of Subchapter J (Electrical Engineering) of this chapter for details.

**§ 78.17–15 Steering gear, whistle, and means of communication.**

(a) On all vessels making a voyage of more than 48 hours' duration, the entire steering gear, the whistle, and the means of communication between the bridge or pilothouse and the engine room shall be examined and tested by an officer of the vessel within a period of not more than 12 hours prior to departure. On all other vessels similar examinations and tests shall be made at least once every week.

(b) The date of the test and the condition of the equipment shall be noted in the official logbook.

**§ 78.17–20 Drafts and load line markings.**

(a) The master of every vessel on an ocean, coastwise, or Great Lakes voyage shall enter the drafts of the vessel, forward and aft, in the official logbook when leaving port.

(b) On vessels subject to the requirements of Subchapter E (Load Lines) of this chapter, at the time of departure from port on an ocean, coastwise, or Great Lakes voyage, the master shall insert in the official logbook a statement of the position of the subdivision load line mark, port and starboard, in relation to the surface of the water in which the vessel is then floating.

(1) When the draft of the vessel is limited by a seasonal load line located below the subdivision load line, the position of the applicable seasonal load line shall be entered in relation to the surface of the water in which the vessel is floating.

(2) When an allowance for draft is made for density of the water in which the vessel is floating, this density is to be noted in the official logbook.

**§ 78.17–25 Sanitation.**

(a) It shall be the duty of the master and chief engineer to see that the vessel and, in particular, the passenger and crew quarters are in a clean and sanitary condition. The chief engineer shall be responsible only for the sanitary condition of the engineering department.

**§ 78.17–30 Examination of boilers and machinery.**

(a) It shall be the duty of the chief engineer when he assumes charge of the boilers and machinery of a vessel to examine them thoroughly. If any parts thereof are in bad condition, or if the safety valve seals are broken, the fact shall immediately be reported to the master, owner or agent, and the Officer in Charge, Marine Inspection.

**§ 78.17–35 Hatches and other openings.**

(a) It shall be the responsibility of the master to assure himself before leaving protected waters that all exposed cargo hatches of his vessel are closed and made properly tight.

(b) The following doors, portable plates, ports, and other openings shall be kept closed while the vessel is being navigated, and shall be closed before the vessel commences a voyage:

(1) Watertight doors between cargo spaces as provided in § 73.35–17(b) of this subchapter.

(2) Portable plates in watertight bulkheads as provided in § 73.30–35 (a) of this subchapter.

(3) Gangway, cargo, and coaling ports fitted below the margin line.

(4) On ocean, coastwise, or Great Lakes vessels of 150 gross tons and over, all opening type port lights in a 'tween deck, if the sill of any port light in that 'tween deck, is below a line drawn parallel to the bulkhead deck at side and having its lowest point 4½ feet plus 2½ percent of the breadth of the vessel above the water when the vessel departs from port. The Commandant may indicate the limiting mean draft which would allow such port lights to be opened at sea.

(5) Port lights that are not accessible during navigation. Dead covers on such port lights shall also be secured.

(6) Port lights in spaces appropriated alternately to the carriage of cargo and passengers, when cargo is carried. Dead covers on such port lights shall also be secured.

(c) The time of opening and closing of hatches and other openings noted in this section shall be entered in the official logbook. In the event that the master at his discretion does not secure the hatches, a notation of this fact shall be made in the official logbook. If it becomes essential for the safety of the vessel to open any of the fittings noted in this section while at sea, the circumstances and the time of opening and closing shall be entered in the official logbook.

(d) The time of opening, closing, and securing, at sea, of watertight doors fitted between bunkers for the purpose of trimming coal, shall be entered in the official logbook.

**§ 78.17–40 Line-throwing appliances.**

(a) On vessels fitted with a line-throwing appliance, it shall be the duty of the master to drill his crew in the use of such appliance, and require it to be fired at least once in every 3 months. Each drill shall be recorded in the vessel's official logbook. The service line shall not be used for drill purposes. The drill shall be conducted as follows:

(1) For impulse-projected rocket type, by actually firing the rocket with any flexible line of proper size and length, suitably faked or laid out.

(2) For shoulder gun type, by actually firing, using the regular cartridge and projectile with any flexible line of proper size and length, suitably faked or laid out.

(3) For Lyle gun type, by actually firing, using 2½ ounces of powder, the regular service projectile with any flexible line of proper size and length suitably faked or laid out.

**§ 78.17–45 Emergency lighting and power systems.**

(a) It shall be the duty of the master to see that the emergency lighting and power systems are operated and inspected at least once in each week that the vessel is navigated to be assured that the system is in proper operating condition.

(b) Internal combustion engine driven emergency generators shall be operated under load for at least 2 hours, at least once in each month that the vessel is navigated.

(c) Storage batteries for emergency lighting and power systems shall be tested at least once in each 6-month period that the vessel is navigated to demonstrate the ability of the storage battery to supply the emergency loads for the specified period of time.

(d) The date of the tests and the condition and performance of the apparatus shall be noted in the official logbook.

**§ 78.17–50 Fire and boat drills.**

(a) The master shall be responsible for conducting a fire and boat drill at least once in every week. In the case of a vessel where the duration of the voyage exceeds 1 week, a fire and boat drill shall be held before the vessel leaves port and at least once a week thereafter. On all vessels on an international voyage other than a short international voyage, a muster of the passengers for fire and boat drill shall be held within 24 hours after leaving port.

(b) The fire and boat drill shall be conducted as if an actual emergency existed. All hands should report to their respective stations and be prepared to perform the duties specified in the station bill.

(1) Fire pumps shall be started and a sufficient number of outlets used to ascertain that the system is in proper working order.

(2) All rescue and safety equipment shall be brought from the emergency equipment lockers and the persons designated shall demonstrate their ability to use the equipment.

(3) All watertight doors which are in use while the vessel is under way and all fire doors shall be operated.

(4) Weather permitting, lifeboat covers and strongbacks shall be removed, plugs or caps put in place, boat ladders secured in position, painters led forward and tended, and other lifesaving equipment prepared for use. The motor and hand-propelling gear of each lifeboat, where fitted, shall be operated for at least 5 minutes.

(5) The passengers shall be encouraged to fully participate in these drills and shall be instructed in the use of the life preservers.

(6) In port, every lifeboat shall be swung out, if practicable, and the unobstructed lifeboats shall be lowered to the water and the crew exercised in the use of the oars and other means of propulsion if provided for the lifeboat. Although all lifeboats may not be used in a particular drill, care shall be taken that all lifeboats are given occasional use to ascertain that all lowering equipment is in proper order and the crew properly trained. The master shall be responsible that each lifeboat is lowered to the water at least once in each 3 months.

(7) When the vessel is under way, and weather permitting, all lifeboats shall be swung out to ascertain that the gear is in proper order.

(8) The person in charge of each lifeboat and liferaft shall have a list of its crew and shall see that the men under his command are acquainted with their duties.

(c) It shall be the duty of the master to ascertain that in connection with the fire and boat drills, or at other times, each member of the crew except female members has been drilled and exercised in pulling oars in lifeboats at least once in each 3 months. In addition, the crew of each motor-propelled lifeboat shall demonstrate their ability in the working of the engine and handling of the lifeboat under power, and the crew of each hand-propelled lifeboat shall demonstrate their ability in the operation of the hand-propelling gear and the operation of the lifeboat under hand power within the same time.

(d) An entry shall be made in the vessel's official logbook relative to each fire and boat drill setting forth the date and hour, length of time of the drill, numbers on the lifeboats swung out and numbers on those lowered, the length of time that motor and hand-propelled lifeboats are operated, the number of lengths of hose used, together with a statement as to the condition of all fire and lifesaving equipment, watertight door mechanisms, valves, etc. If in any week the required fire and boat drills are not held or only partial drills are held, an entry shall be made stating the circumstances and extent of the drills held.

(e) Three copies of certain sections from this part, Form CG–809, shall be framed under glass and posted in conspicuous places about the vessel. These forms may be obtained from the Officer in Charge, Marine Inspection.

**§ 78.17–55 Electric power operated lifeboat winches.**

(a) It shall be the duty of the master to see that all lifeboat winch control apparatus, including motor controllers, emergency switches, master switches, and limit switches, are examined at least once in each 3 months. The examination shall include the removal of drain plugs and/or the opening of drain valves in such appliances to assure that the enclosures are free of water.

(b) The date of the examinations required by this section and the condition of the equipment shall be noted in the official logbook.

**§ 78.17–60 Lifeboats, liferafts, lifefloats, and buoyant apparatus.**

(a) (1) It shall be the duty of the master or person in charge to see that the lifeboats, rescue boats, liferafts, lifefloats, and buoyant apparatus are properly maintained at all times, and that all equipment for his vessel required by the regulations in this subchapter is provided, maintained, and replaced as indicated.

(2) The master shall assign to one or more officers the duty of seeing that the lifeboats, rescue boats, liferafts, lifefloats, and buoyant apparatus are at all times ready for immediate use.

(3) The decks on which lifeboats, rescue boats, liferafts, lifefloats, and buoyant apparatus are stowed shall be kept clear of cargo or any other obstructions which would interfere with the immediate launching of such equipment.

(b) Where motor-propelled lifeboats are carried, the motor of each lifeboat shall be operated in the ahead and astern position for a period of not less than 5 minutes at least once in each week.

(c) All lifeboats, rescue boats and rigid type liferafts shall be stripped, cleaned, and thoroughly overhauled at least once in every year. When lifeboats are removed from a vessel for this purpose on a rotational basis, the installation test prescribed by Subpart 75.35 need not be made.

(d) The fuel tanks of all motor-propelled lifeboats snall be emptied and the fuel changed at least once in every year.

(e) All lifefloats and buoyant apparatus shall be cleaned and thoroughly overhauled at least once in every year.

(f) Inflatable liferafts shall be serviced at an approved service facility every 12 months or not later than the next vessel inspection for certification provided the time since date of last servicing does not exceed 15 months. Except in emergencies no servicing shall be done aboard vessels.

**§ 78.17–65 Smoke detecting system.**

(a) It shall be the duty of the master to see that the smoke inlets in cargo holds are examined at least once in each 3 months by the ship's personnel to determine if the inlets are obstructed by corrosion, paint, dust, or other extraneous matter. Smoke tests shall be made in all holds and the system found or made operable. The date of the test and condition of the system shall be entered in the log.

**§ 78.17–70 Radio apparatus for lifeboats.**

(a) It shall be the duty of the master to require that all batteries for all fixed and portable radio apparatus for lifeboats are brought up to full charge weekly if the batteries are of a type which require recharging.

(b) In any case, the transmitter shall be tested weekly using a suitable artificial aerial.

**§ 78.17–75 Requirements for fuel oil.**

(a) It shall be the duty of the chief engineer to cause an entry in the log be made of each supply of fuel oil received on board, stating the quantity received, the name of the vendor, the name of the oil producer, and the flashpoint (closed

cup test) for which it is certified by the producer.

(b) It shall be the further duty of the chief engineer to cause to be drawn and sealed and suitably labeled at the time the supply is received on board, a half-pint sample of each lot of fuel oil. These samples shall be preserved until the particular supply of oil is exhausted.

**§ 78.17–80 Firefighting equipment, general.**

(a) It shall be the duty of the owner, master, or person in charge to see that the vessel's firefighting equipment is at all times ready for use and that all such equipment required by the regulations in this subchapter is provided, maintained, and replaced as indicated.

(b) It shall be the duty of the owner, master, or person in charge to require and have performed at least once in every twelve months the tests and inspections of all hand portable fire extinguishers, semiportable fire extinguishing systems, and fixed fire extinguishing systems on board, as described in Tables 71.25–20 (a) (1) and 71.25–20 (a) (2) in § 71.25–20 of this subchapter. The owner, master, or person in charge shall keep records of such tests and inspections showing the dates when performed, the number and/or other identification of each unit tested and inspected, and the name(s) of the person(s) and/or company conducting the tests and inspections. Such records shall be made available to the inspector upon request and shall be kept for the period of validity of the vessel's current certificate of inspection. Where practicable these records should be kept in or with the vessel's log book. The conduct of these tests and inspections does not relieve the owner, master, or person in charge of his responsibility to maintain this firefighting equipment in proper condition at all times.

## Subpart 78.20—Steering Orders

**§ 78.20–1 Method of communicating.**

(a) All steering orders shall be given and communicated in terms of "right rudder" where it is intended that the top of the wheel, the rudder blade, and the head of the ship should go to the right, and "left rudder" where it is intended that the top of the wheel, the rudder blade, and the head of the ship should go to the left.

## Subpart 78.23—Whistling

**§ 78.23–1 Unnecessary whistling prohibited.**

(a) The unnecessary sounding of the vessel's whistle is prohibited within any harbor limits of the United States.

## Subpart 78.25—Unauthorized Lights

**§ 78.25–1 Unauthorized lights prohibited.**

(a) The master shall not authorize or permit the carrying of any lights not required by law that in any way will interfere with the distinguishing of the signal lights.

## Subpart 78.27—Searchlights

**§ 78.27–1 Improper use prohibited.**

(a) No person shall flash or cause to be flashed the rays of a searchlight or other blinding light onto the bridge or into the pilothouse of any vessel under way.

## Subpart 78.30—Lookouts, Pilothouse Watch, Patrolmen, and Watchmen

AUTHORITY: The provisions of this Subpart 78.30 interpret or apply R.S. 4477, 4488, as amended; 46 U.S.C. 470, 481. Treasury Department Order 167–38, October 26, 1959, 24 F.R. 8857.

**§ 78.30–5 Pilothouse watch.**

(a) In addition to the licensed deck officer or pilot, there shall be at least one member of the crew also on watch in or near the pilothouse at all times when the vessel is being navigated.

**§ 78.30–10 Supervised patrol.**

(a) The provisions of this section shall apply to all vessels on an international voyage, and to all other vessels having berthed or stateroom accommodations for passengers. This section shall be applicable at all times when passengers are on board.

(b) Between the hours of 10 p. m. and 6 a. m., a supervised patrol shall be maintained so as to completely cover all parts of the vessel accessible to passengers or crew, excepting occupied sleeping accommodations and machinery spaces and similar spaces where a regular watch is maintained.

(c) Clocks, keys, and recording apparatus shall be of an approved type. The station boxes shall have seals placed over the securing screws in order to leave evidence of removal or tampering.

(d) Clocks or key stations shall be so arranged throughout the vessel so as to assure complete coverage of all accessible spaces required by paragraph (b) of this section. The number and location of recording stations, the order in which they are visited, and the number undertaken by one patrolman shall be specifically approved. The stations shall be numbered as required by § 78.47–23. Sufficient watchmen shall be available so that each space will be covered at least once in every hour except as follows:

(1) On existing vessels not constructed in general agreement with §§ 72.05–5 through 72.05–60, of this subchapter, the supervised patrol shall cover all spaces required by paragraph (b) of this section at least once in every 20 minutes.

(2) Public spaces constructed in general agreement with §§ 72.05–5 through 72.05–60, of this subchapter, shall have either an approved fire detecting system installed in such spaces or the supervised patrol shall cover these spaces at least once in every 20 minutes.

(e) The patrolman shall report to the bridge at least once an hour on vessels where the supervised patrol system is not equipped with a recording apparatus in the control station. In vessels requiring more than one patrol route, one patrolman may contact others and make a joint report to the bridge. Failure of a patrolman to follow a prescribed route, or to record each station within the specified time, shall be entered on the record along with the reason for the irregularity.

(f) The patrolman while on duty shall wear a distinctive uniform or badge, and shall have in his possession at all times an efficient flashlight.

(g) A patrolman on duty shall have no other tasks assigned to him.

**§ 78.30–15 Watchmen.**

(a) The provisions of this section shall apply to all vessels not required to have a supervised patrol under the provisions of § 78.30–10. This section shall be applicable at all times when passengers are on board.

(b) During the nighttime, a suitable number of watchmen shall be stationed in the passenger accommodation areas on each deck.

(c) Watchmen shall be under the direct charge of the master or officer in command of the vessel, and shall report to such officer at the pilothouse at fixed intervals not exceeding one hour. Watchmen shall not be required to perform any other duties while on watch.

(d) The uniform of the night watchman shall be conspicuously different from other persons so as to be readily distinguished. A rating badge marked "Watchman" shall be worn on the left sleeve and the front of the cap shall also be marked "Watchman".

(e) The watchman shall have in his possession at all times while on duty an efficient flashlight.

**§ 78.30–20 Master's and officer's responsibility.**

(a) Nothing in this part shall exonerate any master or officer in command from the consequences of any neglect to keep a proper lookout or to maintain a proper fire watch or from any neglect of any precaution which may be required by the ordinary practice of seamen or by the special circumstances of the case. When circumstances require it, additional watches shall be maintained to guard against fire or other danger and to give an alarm in case of accident or disaster.

**§ 78.30–30 Reckless or negligent operation prohibited by law.**

(a) Subsection 13(a) of the Act of April 25, 1940 (46 U.S.C. 526l), reads as follows:

> No person shall operate any motorboat or any vessel in a reckless or negligent manner so as to endanger the life, limb, or property of any person. To "operate" means to navigate or otherwise use a motorboat or a vessel.

## Subpart 78.33—Reports of Accidents, Repairs, and Unsafe Equipment

AUTHORITY: The provisions of this Subpart 78.33 interpret or apply R.S. 4450, as amended, 4453, as amended, sec. 10, 18 Stat. 128, as amended; 46 U.S.C. 239, 435, 33 U.S.C. 361.

**§ 78.33–1 Repairs of boiler and pressure vessels.**

(a) Before making any repairs to boilers or unfired pressure vessels, the chief engineer shall submit a report covering the nature of the repairs to the Officer in Charge, Marine Inspection, at or nearest the port where the repairs are to be made.

**§ 78.33–5 Accidents to machinery.**

(a) In the event of an accident to a boiler, unfired pressure vessel, or machinery tending to render the further use of the item unsafe until repairs are made, or if by ordinary wear such items become unsafe, a report shall be made by the chief engineer immediately to the Officer in Charge, Marine Inspection, or if at sea, immediately upon arrival at port.

**§ 78.33–10 Notice required before repairs.**

(a) No repairs or alterations, except in an emergency, shall be made to any lifesaving or fire detecting or extinguishing equipment without advance notice to the Officer in Charge, Marine Inspection. When emergency repairs or alterations have been made, notice shall be given to the Officer in Charge, Marine Inspection, as soon as practicable.

**§ 78.33–20 Breaking of safety valve seal.**

(a) If at any time it is necessary to break the seal on a safety valve for any purpose, the chief engineer shall advise the Officer in Charge, Marine Inspection, at the next port of call, giving the reason for breaking the seal and requesting that the valve be examined and adjusted by an inspector.

(R.S. 4419, as amended; 46 U.S.C. 393)

## Subpart 78.35—Cable Traveler

**§ 78.35–1 When required.**

(a) On vessels where the distance between deck houses is more than 150 feet, a wire cable shall be stretched between the deck houses at all times when the vessel is navigating in other than protected waters. As many loose rings with lanyards shall be attached as deemed necessary by the master. In any case, a properly constructed raised catwalk or raised bridge or a below deck passage may be substituted for the required cable.

(Interprets or applies R.S. 4488, as amended; 46 U.S.C. 481)

## Subpart 78.36—Work Vests

AUTHORITY: The provisions of this Subpart 78.36 interpret or apply R.S. 4488, as amended, 4491, as amended, sec. 17, 54 Stat. 166; 46 U.S.C. 481, 489, 526p.

**§ 78.36–1 Application.**

(a) Provisions of this subpart shall apply to all vessels inspected and certificated in accordance with this subchapter.

**§ 78.36–5 Approved unicellular plastic foam work vests.**

(a) Buoyant work vests carried under the permissive authority of this subpart shall conform to the specifications contained in Subpart 160.053 in Subchapter Q (Specifications) of this chapter.

**§ 78.36–10 Use.**

(a) Approved buoyant work vests are considered to be items of safety apparel and may be carried aboard vessels to be worn by crew members when working near or over the water under favorable working conditions. They shall be used under the supervision and control of designated ship's officers. When carried, such vests shall not be accepted in lieu of any portion of the required number of approved life preservers and shall not be substituted for the approved life preservers required to be worn during drills and emergencies.

**§ 78.36–15 Shipboard stowage.**

(a) The approved buoyant work vests shall be stowed separately from the regular stowage of approved life preservers.

(b) The locations for the stowage of work vests shall be such as not to be easily confused with that for approved life preservers.

**§ 78.36–20 Shipboard inspections.**

(a) Each work vest shall be subject to examination by a marine inspector to determine its serviceability. If found to be satisfactory, it may be continued in service, but shall not be stamped by a marine inspector with a Coast Guard stamp. If a work vest is found not to be in a serviceable condition, then such work vest shall be removed from the vessel. If a work vest is beyond repair, it shall be destroyed or mutilated in the presence of a marine inspector so as to prevent its continued use as a work vest.

## Subpart 78.37—Logbook Entries

**§ 78.37–1 Application.**

(a) Except as specifically noted, the provisions of this subpart shall apply to all vessels.

**§ 78.37–3 Logbooks and records.**

(a) Under various statutes or by regulations in this subchapter, vessels engaged in all trades, with the exception of vessels engaged exclusively in trade on rivers of the United States, shall have certain logbooks or records, and, when the occasion arises, it is the duty of the Master or person in charge to place therein specific entries as required by law or regulations in this subchapter.

(b) R.S. 4290, as amended (46 U.S.C. 201), states: "Every vessel making voyages from a port in the United States to any foreign port, or, being of the burden of 75 tons or upward, from a port on the Atlantic to a port on the Pacific, or vice versa, shall have an Official Logbook; * * *." This Official Logbook is furnished gratuitously to masters of United States' flag vessels by the Coast Guard, as Form CG–706B or CG–706C, depending upon the number of persons employed as crew. There is printed in the first several pages of this Official Logbook various acts of Congress relating to logbooks and the entries required to be made therein. When a voyage is completed, or after a specified period of time is completed, the Official Logbooks with required entries therein shall be filed with the Officer in Charge, Marine Inspection, at or nearest the port where the vessel may be.

(c) For vessels other than those required to have Official Logbooks by R.S. 4290, the owners, operators, and/or masters are to supply their own logs or records in any form desired, which will be considered to take the place of the Official Logbooks and may be used for the purpose of making entries therein as required by law or regulations in this subchapter. Such logs or records are not filed with the Officer in Charge, Marine Inspection, but shall be kept available for review by a marine inspector for a period of one year after the date to which the records refer.

**§ 78.37–5 Actions required to be logged.**

(a) The actions and observations noted in this section shall be entered in the official log book. This section contains no requirements which are not made in other portions of this subchapter, the items being merely grouped together for convenience.

(1) Fire and Boat Drills: Weekly. See § 78.17–50.

(2) Watertight door operation: Daily and Weekly. See § 78.17–3.

(3) Valve and closing appliance operation: Weekly. See § 78.17–5.

(4) Loudspeaker system: Weekly. See § 78.17–10.

(5) Steering gear, whistle, and means of communication: Prior to departure. See § 78.17–15.

(6) Drafts and load line markings: Prior to leaving port, ocean, coastwise, and Great Lakes services only. See § 78.17–20.

(7) Hatches and other openings: All openings and closings, or leaving port without closing, except vessels on protected waters. See § 78.17–35.

(8) Line throwing appliances: Once every 3 months. See § 78.17–40.

(9) Emergency lighting and power systems: Weekly and semiannually. See § 78.17–45.

(10) Electric power operated lifeboat winches: Once every 3 months. See § 78.17–55.

(11) Smoke Detecting System: Once every 3 months. See § 78.17–65.

(12) Fuel oil data: Upon receipt of fuel oil on board. See § 78.17–75.

(13) Cargo gear inspections: At least once a month. See § 71.47–70 of this subchapter.

**§ 78.37–10 Official log entries.**

(a) In addition to other items required to be entered in the official logbook on every vessel where an official logbook is required, all items relative to the crew and passengers, including the count of passengers carried, and to casualties shall also be entered.

(b) Except as noted in subparagraph (1) of this paragraph, on any vessel where an official logbook is not required, the master shall keep a record of the correct count of all the passengers received and delivered from day to day. This record shall be open to inspection

by the Coast Guard at all times. The aggregate number of the passengers carried shall be furnished to the Coast Guard whenever requested (R. S. 4467, as amended, 46 U. S. C. 460). The information shall be available for a period of one year after the date to which the records refer.

(1) The provisions of the paragraph shall not apply to ferry vessels.

## Subpart 78.40—Vehicular Ferries

### § 78.40–1 Stowage of vehicles.

(a) Automobiles or other vehicles shall be stowed in such a manner as to permit both passengers and operators to get out and away from them freely in the event of fire or other disaster. Where there is insufficient clearance to provide for easy egress at all times, both passengers and operators shall be directed to leave their vehicles and to occupy other spaces reserved for them during the crossing. The decks, where necessary, shall be definitely marked with painted lines to indicate the vehicle runways and the aisle spaces.

### § 78.40–5 Securing of vehicles.

(a) The master shall take all necessary precautions to see that automobiles or other vehicles have their motors turned off when the ferry is under way, and the motors shall not be started until the ferry is secured to the landing. In addition, the vehicles at each end shall have their wheels securely blocked, while the vessel is being navigated.

### § 78.40–10 No smoking permitted.

(a) The master shall have appropriate "No Smoking" signs posted and shall take all necessary precautions to prevent smoking or carrying of lighted or smoldering cigars, cigarettes, etc., in the deck area assigned to automobiles or other vehicles.

## Subpart 78.43—Railroad Passenger Car Ferries

### § 78.43–1 Precautions for railway passenger cars.

(a) It shall be the duty of the master of any railroad passenger car ferry to see that all of the doors of the cars are unlocked and that the vestibules of the cars are open while the cars are on the ferry, to allow the persons so carried free access at all times.

## Subpart 78.45—Display of Plans

### § 78.45–1 When required.

(a) Vessels of 1,000 gross tons and over, and vessels of any tonnage on an international voyage shall have permanently exhibited for the guidance of the officer in charge of the vessel the following plans:

(1) General arrangement plans showing for each deck the fire control stations, the various sections enclosed by fire-resisting bulkheads, the sections enclosed by fire-retarding bulkheads, together with particulars of the fire alarms, detecting systems, the sprinkler installation (if any), the fire extinguishing appliances, means of access to different compartments, decks, etc., and the ventilating systems including particulars of the master fan controls, the positions of dampers, the location of the remote means of stopping the fans, and identification numbers of the ventilating fans serving each section. Alternatively, at the discretion of the Commandant, the aforementioned details may be set out in a booklet, a copy of which shall be supplied to each officer, and one copy at all times shall be available on board in an accessible position.

(2) Plans showing clearly for each deck and hold the boundaries of the watertight compartments, the openings therein with the means of closure and position of any controls thereof, and the arrangements for the correction of any list due to flooding.

(3) Plans and booklets shall be kept up-to-date, any alteration being recorded thereon as soon as practicable.

(R.S. 4488, as amended, sec. 5, 49 Stat. 1384, as amended; 46 U.S.C. 481, 369. Treasury Department Order 167–38, October 26, 1959, 24 F.R. 8857)

## Subpart 78.47—Markings for Fire and Emergency Equipment, Etc.

AUTHORITY: The provisions of this Subpart 78.47 interpret or apply R.S. 4488, as amended; 46 U.S.C. 481. Treasury Department Order 167–38, Oct. 26, 1959, 24 F.R. 8857.

### § 78.47–1 Application.

(a) The provisions of this subpart with the exception of § 78.47–90, shall apply to all vessels contracted for on or after November 19, 1952. Vessels contracted for prior to November 19, 1952, shall meet the requirements of § 78.47–90.

### § 78.47–3 General.

(a) It is the intent of this subpart to provide such markings as are necessary for the guidance of the persons on board in case of emergency. In any specific case, and particularly on small vessels, where it can be shown to the satisfaction of the Officer in Charge, Marine Inspection, that the prescribed markings are unnecessary for the guidance of the persons on board in case of emergency, such markings may be modified or omitted.

(b) In addition to English, all stateroom notices, directional signs, etc., shall be printed in languages appropriate to the service of the vessel or other action be taken to achieve the same purpose.

(c) Where in this subpart red letters are specified, letters of a contrasting color on a red background will be accepted.

### § 78.47–5 General alarm bell switch.

(a) The general alarm bell switch in the pilothouse, and in the fire control station, if also located there, shall be clearly and permanently identified by lettering on a metal plate or with a sign in red letters on a suitable background: "GENERAL ALARM."

CROSS REFERENCE: See also § 113.25–20 of Subchapter J (Electrical Engineering) of this chapter.

### § 78.47–7 General alarm bells.

(a) All general alarm bells shall be identified by red lettering at least ½ inch high: "GENERAL ALARM—WHEN BELL RINGS GO TO YOUR STATION."

### § 78.47–9 Carbon dioxide alarm.

(a) All carbon dioxide alarms shall be conspicuously identified: "WHEN ALARM SOUNDS—VACATE AT ONCE. CARBON DIOXIDE BEING RELEASED."

### § 78.47–10 Manual alarm boxes.

(a) In all new installations, manual alarm boxes shall be clearly and permanently marked "IN CASE OF FIRE BREAK GLASS." Existing boxes not so marked with the same or equivalent wording, shall be identified either on the box or adjacent bulkhead in at least ½ inch letters "IN CASE OF FIRE BREAK GLASS." All manual alarm boxes shall be numbered in red on the adjacent bulkhead with at least ½ inch figures. The number shall agree with the number of the zone.

### § 78.47–13 Fire detecting and manual alarm, automatic sprinkler, and smoke detecting alarm bells.

(a) The fire detecting and manual alarm automatic sprinkler, and smoke detecting alarm bells in the engine room shall be identified by at least 1 inch red lettering "FIRE ALARM", "SPRINKLER ALARM" or "SMOKE DETECTING ALARM" as appropriate. Where such alarms on the bridge or in the fire control station do not form a part of an easily identifiable alarm cabinet, the bells shall be suitably identified as above.

### § 78.47–15 Fire extinguishing system branch lines.

(a) The branch line valves of all fire extinguishing systems shall be plainly and permanently marked indicating the spaces served.

### § 78.47–17 Fire extinguishing system controls.

(a) The control cabinets or spaces containing valves or manifolds for the various fire extinguishing systems shall be distinctly marked in conspicuous red letters at least 2 inches high—"STEAM FIRE APPARATUS", "CARBON DIOXIDE FIRE APPARATUS", "FOAM FIRE APPARATUS", "WATER SPRAY FIRE APPARATUS", "MANUAL SPRINKLING SYSTEM", or "AUTOMATIC SPRINKLING SYSTEM", as the case may be.

### § 78.47–20 Fire hose stations.

(a) Each fire hydrant shall be identified in red letters and figures at least 2 inches high "FIRE STATION NO 1," "2," "3," etc. Where the hose is not stowed in the open or behind glass so as to be readily seen, this identification shall be so placed as to be readily seen from a distance.

### § 78.47–23 Supervised patrol stations.

(a) Each supervised patrol clock or key station shall be numbered.

**§ 78.47–25 Emergency squad equipment.**

(a) Lockers or spaces containing equipment for the use of the emergency squad shall be marked "EMERGENCY SQUAD EQUIPMENT."

**§ 78.47–27 Self-contained breathing apparatus and gas masks.**

(a) Lockers or spaces containing self-contained breathing apparatus or gas masks shall be marked "SELF-CONTAINED BREATHING APPARATUS" or "GAS MASK."

**§ 78.47–30 Hand portable fire extinguishers.**

(a) Each hand portable fire extinguisher shall be marked with a number and the location where stowed shall be marked with a corresponding number at least ½ inch high. Where only one type and size of hand portable fire extinguisher is carried, the numbering may be omitted.

**§ 78.47–33 Emergency lights.**

(a) All emergency lights shall be marked with a letter "E" at least ½ inch high.

**§ 78.47–35 Fire doors.**

(a) All doors in main vertical zone bulkheads or stairway enclosures, except from individual rooms such as staterooms, fan rooms, lockers, etc., shall be numbered conspicuously on an etched plate or equivalent in not less than ⅜ inch letters and figures "F. S. D. 1," "2," "3," etc. If stenciled or similar notice is used, the letters and figures shall be at least 1 inch high. The number shall be conspicuous with the door in the open position.

**§ 78.47–37 Watertight doors.**

(a) All watertight doors in subdivision bulkheads shall be numbered conspicuously on both sides on an etched plate or equivalent in not less than ⅜ inch letters and figures "W. T. D. 1," "2," "3," etc. If a stencilled or similar notice is used, the letters and figures shall be at least 1 inch high. If the construction is such that the number cannot be seen with the door in the open position, a similar number shall be placed on the frame or other location immediately adjacent to the door. All watertight door remote control stations shall be marked in the same manner, and in addition, the direction of operation of the lever or wheel to open and close the door shall be conspicuously marked.

(b) Class 1 doors fitted in accordance with § 73.35–5(b) of this subchapter shall additionally be marked "RECLOSE AFTER USE."

**§ 78.47–38 Valves and closing appliances.**

(a) All valves and closing appliances, or other mechanisms which may be required to be operated for damage control purposes in case of emergency shall be conspicuously marked with letters at least 1 inch high identifying the control and the direction of operation. In all cases indication shall be provided to show whether the control is open or closed.

**§ 78.47–40 Exit signs.**

(a) Illuminated signs bearing the word "EXIT" in red letters shall be installed in such locations throughout the vessel that from any portion of the vessel normally accessible to the passengers or crew, except machinery spaces, and stores and similar spaces where the crew are not normally employed, so that, with all fire doors in stairway enclosures and main vertical zone bulkheads and all watertight doors closed, the direction of escape to the open deck will be apparent. For the purpose of this paragraph, individual staterooms and other similar small rooms will not be required to have such signs, but upon emerging from such rooms the direction of escape should be apparent. The power for the illuminated exit signs shall be from the emergency switchboard.

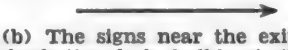
(b) Small rooms or spaces having a secondary means of escape which is not obviously apparent shall have a suitable sign in red letters "EMERGENCY EXIT" directing attention to such escape.

CROSS REFERENCE: See § 111.50–15(d) of Subchapter J (Electrical Engineering) of this chapter for minimum size.

**§ 78.47–43 Embarkation direction signs to lifeboats.**

(a) Sufficient embarkation direction signs shall be installed in passageways, stairways, etc., throughout the vessel that from any portion of the vessel normally accessible to the passengers or crew, and with all fire doors in stairway enclosures and main vertical zone bulkheads and all closed watertight doors in subdivision bulkheads, the direction of the shortest route to follow to reach the lifeboats will be apparent. The signs shall be in at least 1 inch letters with arrows of appropriate dimensions:

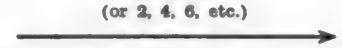
TO BOATS



(b) The signs near the exits to the embarkation deck shall be similar to the above, and shall indicate the boat stations nearest to the exit:

TO BOAT STATIONS

NOS. 1, 3, 5
(or 2, 4, 6, etc.)



(c) Any combination of arrows and one inch lettering which will clearly indicate the direction to be followed will be acceptable.

**§ 78.47–45 Lifeboat stations.**

(a) There shall be placed on the deck beams or suspended athwartship from overhead at each lifeboat station on the embarkation deck a sign in three-inch letters "LIFEBOAT STATION NO. 1," "2," "3," etc. If there is insufficient head room or no overhead structure at a boat station, a similar sign shall be permanently installed where it will be readily seen.

**§ 78.47–47 Stateroom notices.**

(a) Framed notices shall be conspicuously posted in the passenger staterooms indicating the following which may be posted separately or together.

(1) Emergency signal:

EMERGENCY SIGNALS

FIRE AND EMERGENCY—CONTINUOUS RAPID RINGING OF THE SHIP'S BELL AND OF THE GENERAL ALARM BELLS FOR A PERIOD OF NOT LESS THAN 10 SECONDS.

ABANDON SHIP (OR BOAT STATIONS)—MORE THAN 6 SHORT BLASTS AND ONE LONG BLAST OF THE WHISTLE SUPPLEMENTED BY THE SAME SIGNAL ON THE GENERAL ALARM BELLS.

THE OCCUPANTS OF THIS ROOM ARE ASSIGNED TO LIFEBOAT NO. _____. ALL PASSENGERS ARE REQUIRED TO PUT ON LIFE PRESERVERS AND GO TO THEIR LIFEBOAT STATIONS WHENEVER GENERAL ALARM BELLS RING.

THE ROOM STEWARD WILL PROVIDE LIFE PRESERVERS FOR CHILDREN AT THE START OF THE VOYAGE.

(2) Life preservers: The location of life preservers together with instructions and pictures showing how they are worn shall be indicated in a framed notice.

**§ 78.47–50 Children's life preservers.**

(a) The lockers or boxes in which children's life preservers are stowed and also the number contained therein shall be marked in at least two inch letters and figures:

20

CHILDREN'S LIFE PRESERVERS

**§ 78.47–53 Automatic ventilation dampers.**

(a) The manual operating positions for automatic fire dampers in ventilation ducts passing through main vertical zone bulkheads shall be identified by red letters at least ½ inch high "VENTILATION FIRE DAMPER." In addition, the open and closed positions shall be similarly marked.

**§ 78.47–55 Instructions for changing steering gear.**

(a) Instructions in at least ½ inch letters and figures shall be posted in the steering engine room, relating in order, the different steps to be taken in changing to the emergency steering gear. Each clutch, gear, wheel, lever, valve or switch which is used during the change-over shall be numbered or lettered on a metal plate or painted so that the markings can be recognized at a reasonable distance. The instructions shall indicate each clutch or pin to be "in" or "out" and each valve or switch which is to be "opened" or "closed" in shifting to any means of steering for which the vessel is equipped. Instructions shall be included to line up all steering wheels and rudder amidship before changing gears.

**§ 78.47–57 Rudder orders.**

(a) At all steering stations, there shall be installed a suitable notice on the wheel or device or in such other position as to be directly in the helmsman's line of vision, to indicate the direction in which the wheel or device must be turned for "right rudder" and for "left rudder."

**§ 78.47–60 Lifeboats.**

(a) The name of the vessel shall be plainly marked or painted on each side of the bow of each lifeboat in letters not less than 3 inches high. For vessels on an international voyage, the vessel's port of registry shall be added in similar type letters.

(b) The number of each lifeboat shall be plainly marked or painted on each side of the bow of each lifeboat in figures not less than 3 inches high. The lifeboats on each side of the vessel shall be numbered from forward aft, with the odd numbers on the starboard side. Where nested lifeboats are permitted, the upper lifeboat shall be numbered in the normal manner and the lower lifeboat shall have the same number followed by the letter "A".

(c) The cubical contents and number of persons allowed to be carried in each lifeboat shall be plainly marked or painted on each side of the bow of each lifeboat in letters and numbers not less than 1½ inches high. In addition, the number of persons allowed shall be plainly marked or painted on top of at least 2 thwarts in letters and numbers not less than 3 inches high.

(d) All oars shall be conspicuously marked with the vessel's name.

(e) Where mechanical disengaging apparatus is used, the control effecting the release of the lifeboat shall be painted bright red and shall have thereon in raised letters either the words—"DANGER—LEVER DROPS BOAT", or the words—"DANGER—LEVER RELEASES HOOKS".

(f) The top of thwarts, side benches and footings of lifeboats shall be painted or otherwise colored international orange. The area in way of the red mechanical disengaging gear control lever, from the keel to the side bench, shall be painted or otherwise colored white, to provide a constrasting background for the lever. This band of white should be approximately 12 inches wide depending on the internal arrangements of the lifeboat.

**§ 78.47–63 Liferafts, lifefloats, and buoyant apparatus.**

(a) Rigid type liferafts, lifefloats, and buoyant apparatus, together with their oars and paddles, shall be conspicuously marked with the vessel's name. For vessels on an international voyage, the vessel's port of registry also shall be similarly marked on lifefloats and buoyant apparatus.

(b) The number of persons allowed on each rigid type liferaft, lifefloat, and buoyant apparatus shall be conspicuously marked or painted thereon in letters and numbers at least 1½ inches high.

(c) There shall be stenciled in a conspicuous place in the immediate vicinity of each inflatable liferaft the following:

INFLATABLE LIFERAFT NO. ------
------ PERSONS CAPACITY

These markings shall not be placed on the inflatable liferaft containers.

NOTE: § 160.051–8(a) of Subchapter Q (Specifications) of this chapter requires permanently attached nameplates on each inflatable liferaft and carrying case. The nameplate contains the following information: The name of manufacturer, approval number, the manufacturer's model number, serial number, and lot number, and the number of persons for which the inflatable liferaft is approved. In addition, the carrying case shall be marked "Ocean Service Equipment" or "Limited Service Equipment" as applicable, together with the marine inspector's initials, the date, and the letters "USCG."

**§ 78.47–65 Life preservers, wood floats, and ring life buoys.**

(a) All life preservers, wood floats, and ring life buoys shall be marked with the vessel's name. For vessels on an international voyage, the vessel's port of registry shall be added in similar type letters on all ring life buoys.

**§ 78.47–67 Fire hose and axes.**

(a) All fire hose and axes shall be marked with the vessel's name.

**§ 78.47–70 Portable magazine chests.**

(a) Portable magazine chest shall be marked in letters of at least 3 inches high "PORTABLE MAGAZINE CHEST—FLAMMABLE—KEEP LIGHTS AND FIRE AWAY".

**§ 78.47–90 Vessels contracted for prior to November 19, 1952.**

(a) Vessels contracted for prior to November 19, 1952, shall meet the requirements of this paragraph.

(1) The requirements of §§ 78.47–5 through 78.47–70 shall be met with the exception that existing signs and markings containing the same general intent, but not necessarily identical wording or exact letter type, size, or color, may be retained so long as they are in good condition to the satisfaction of the Officer in Charge, Marine Inspection.

## Subpart 78.49—Posting Placards of Instructions for Launching and Inflating Inflatable Liferafts

**§ 78.49–1 When required.**

(a) Every vessel equipped with inflatable liferafts shall have posted in conspicuous places which are regularly accessible to the crew and/or passengers, approved placards containing instructions for launching and inflating inflatable liferafts for the information of persons on board. The number and location of such placards shall be as determined necessary by the Officer in Charge, Marine Inspection.

(b) Under the requirements contained in § 160.051–6(c)(1) of Subpart 160.051 in Subchapter Q (Specifications) of this chapter, the manufacturer of approved inflatable liferafts is required to provide approved placards containing such instructions with each liferaft.

## Subpart 78.50—Markings on Vessels

**§ 78.50–1 Application.**

(a) The provisions of this subpart shall apply to all vessels except as specifically noted in this subpart.

**§ 78.50–5 Markings required by customs regulations.**

(a) The following markings are required by the Customs Regulations. Details of the application of the requirements as well as details of the required markings will be found in those regulations:

(1) Name of Vessel—On both bows and the stern. On steam vessels the name is also required on both sides of the pilothouse, and on steam paddle wheel vessels on the outer side of each paddle box.

(2) Hailing Port—On the stern.

(3) Official Number—On the vessel's main beam.

(4) Net Tonnage—On the vessel's main beam.

**§ 78.50–10 Draft marks.**

(a) All vessels 50 gross tons and over, under the jurisdiction of the U.S. Coast Guard, shall have the draft of the vessel plainly and legibly marked upon the stem and upon the sternpost or rudderpost or at any place at the stern of the vessel as may be necessary for easy observance. The draft shall be taken from the bottom of the keel at the marks to the surface of the water, the bottom of the mark to indicate the draft in feet.

(b) In cases where the keel does not extend forward or aft to the location of the draft marks, due to raked stem or cut-away skeg, the datum line from which the draft shall be taken shall be obtained by projecting the line of the bottom of keel forward or aft, as the case may be, to the location of the draft marks.

(c) In cases where a vessel may have a skeg or other appendage extending locally below the line of the keel, the draft at the end of the vessel adjacent to such appendage shall be measured to a line tangent to the lowest part of such appendage and parallel to the line of the bottom of the keel.

**§ 78.50–15 Load line marks.**

(a) Vessels assigned a load line shall have the deck line and the load line marks permanently scribed or embossed as required by Subchapter E (Load Lines) of this chapter.

## Subpart 78.53—Placard of Lifesaving Signals and Breeches Buoy Instructions

**§ 78.53–1 Application.**

(a) The provisions of this subpart shall apply to all vessels on an international voyage, and to all other vessels of 150 gross tons or over in ocean, coastwise or Great Lakes service.

**§ 78.53–5 Availability.**

(a) On all vessels to which this subpart applies there shall be posted in the pilothouse and readily available to the deck officer of the watch a placard (Form CG–811) containing instructions for the use of breeches buoys and the lifesaving signals as set forth in Regulation 16, Chapter V, of the International Convention for Safety of Life at Sea, 1960.

These signals shall be used by vessels or persons in distress when communicating with lifesaving stations and maritime rescue units.

(b) A copy of Form CG–811 shall also be conveniently posted in the engineroom and crews quarters of all vessels to which this subpart applies.

## Subpart 78.55—Carrying of Excess Steam

### § 78.55–1 Master and chief engineer responsible.

(a) It shall be the duty of the master and the engineer in charge of the boilers of any vessel to require that a steam pressure is not carried in excess of that allowed by the certificate of inspection, and to require that the safety valves, once set and sealed by the inspector, are in no way tampered with or made inoperative except as provided in § 78.33–20.

## Subpart 78.57—Routing Instructions

### § 78.57–1 All personnel must comply.

(a) Due to existing mine field dangers, all licensed masters, officers, and certificated seamen on United States vessels shall comply strictly with the routing instructions issued by competent naval authority. Failure to comply with such routing instructions shall be deemed misconduct within the meaning of R. S. 4450, as amended (46 U. S. C. 239). Nothing herein shall be construed as relieving the master of the responsibility for the safety of his vessel.

## Subpart 78.60—Compliance With Provisions of Certificate of Inspection

### § 78.60–1 Master or person in charge responsible.

(a) It shall be the duty of the master or other person in charge of the vessel to see that all of the provisions of the certificate of inspection are strictly adhered to. Nothing in this subpart shall be construed as limiting the master or other person in charge of the vessel, at his own responsibility, from diverting from the route prescribed in the certificate of inspection or taking such other steps as he deems necessary and prudent to assist vessels in distress or for other similar emergencies.

## Subpart 78.65—Exhibition of License

### § 78.65–1 Licensed officers.

(a) All licensed officers on a vessel shall have their licenses conspicuously displayed as required by R.S. 4446, as amended (46 U.S.C. 232).

## Subpart 78.70—De-Energizing of Cargo Hold Lighting Circuits When Grain or Other Combustible Bulk Cargo Is Carried

AUTHORITY: The provisions of this Subpart 78.70 interpret or apply R.S. 4488, as amended, sec. 17, 54 Stat. 166, as amended; 46 U.S.C. 481, 526p. Treasury Department Order 167–38, October 26, 1959, 24 F.R. 8857.

### § 78.70–1 Master's responsibility.

(a) Before loading bulk grain, or similar combustible bulk cargo, the master shall have the lighting circuits to cargo compartments in which the bulk cargo is to be loaded de-energized at the distribution panel or panel board. He shall thereafter have periodic inspections made of the panel or panel board as frequently as necessary to ascertain that the affected circuits remain de-energized while this bulk cargo remains within the vessel.

### § 78.70–5 Warning notice posted.

(a) As a precaution against any subsequent unintentional re-energizing of the circuits specified above, an appropriate notice shall be posted at the location where the control is effected warning against re-energizing these circuits. Such notice shall remain posted while this bulk cargo remains within the vessel.

## Subpart 78.75—Motion Picture Film and Equipment

### § 78.75–1 Type required.

(a) Only acetate or slow-burning film may be used. Nitrocellulose film is specifically prohibited.

(b) Projectors shall be of an approved type.

(R.S. 4488, as amended, 46 U.S.C. 481. Treasury Department Order 167–38, October 26, 1959, 24 F.R. 8857)

## Subpart 78.80—Power-Operated Industrial Trucks

AUTHORITY: The provisions of this Subpart 78.80 interpret or apply R.S. 4417a, as amended, 4472, as amended, 4488, as amended, 4491, as amended; 46 U.S.C. 391a, 170, 481, 489. Treasury Department Order 167–38, October 26, 1959, 24 F.R. 8857.

### § 78.80–1 Application.

(a) *Power-operated industrial trucks.* (1) Except as provided in subparagraph (3) of this paragraph, power-operated industrial trucks carried on board vessel as part of the vessel's equipment for handling materials of any kind shall be in compliance with the applicable provisions of this subpart.

(2) Except as provided in subparagraph (3) of this paragraph, power-operated industrial trucks placed on board vessels for handling materials of any kind shall be in compliance with the applicable provisions of this subpart when such vessels are within the navigable waters of the United States, its territories and possessions but not including the Panama Canal Zone.

(3) When power-operated industrial trucks are used in spaces not containing dangerous or hazardous articles, as set forth in § 78.80–10(f) of this subpart, the installation of the minimum safety features of § 78.80–7(c) shall be carried out at the earliest opportunity but in any case not later than July 1, 1963.

(b) *Vessels.* (1) Vessels shall be in compliance with the applicable provisions of this subpart during those periods of time when power-operated industrial trucks are on board as part of the vessel's equipment or when such trucks are placed on board for handling materials of any kind.

NOTE: The regulations affecting the use of power-operated industrial trucks on foreign vessels are in Part 146 of Subchapter N (Dangerous Cargoes), or in the case of foreign tank vessels in Subpart 35.70 of Subchapter D (Tank Vessels) of this chapter.

### § 78.80–3 Alternates.

(a) In cases of undue hardship resulting from unavoidable delays in bringing existing power-operated industrial trucks into compliance with the applicable provisions of this subpart, the Commandant may permit the use of alternate equipment, apparatus, or arrangement for such period of time, and to such extent, and upon such conditions as will assure, to the Commandant's satisfaction, a degree of safety consistent with the minimum standards as set forth in this subpart.

(b) The methods and procedures adopted in connection with the modification of existing equipment to meet required laboratory designations will be taken into consideration in granting permission to use alternate arrangements for a limited period of time.

### § 78.80–5 Definitions of terms used in subpart.

(a) Power-operated industrial trucks are considered to be tractors, lift trucks, and other specialized industrial trucks used for material handling on board a vessel.

(b) For the purpose of the regulations in this subpart, the words "flammable" and "inflammable" are interchangeable or synonymous terms.

### § 78.80–7 Approved power-operated industrial trucks.

(a) Where approved power-operated industrial trucks are required by the regulations in this subchapter such approved trucks shall have a specific designation of a recognized testing laboratory. The following laboratories are recognized for the specific type designations listed:

(1) Underwriters' Laboratories, Inc. (Mailing address, P.O. Box 247, Northbrook, Ill., 60062) for trucks having recognized testing laboratory type designations E, EE, EX, G, GS, LP, LPS, D and DS.

(2) Factory Mutual Laboratories, Engineering Division, 1115 Boston-Providence Turnpike, Norwood, Mass., 02062, for trucks having recognized testing laboratory type designations E, EE, EX, G, GS, LP, LPS, D and DS.

(b) Description of recognized testing laboratory type designations are as follows:

(1) The "E" designated units are electrically powered units that have minimum acceptable safeguards against inherent fire hazards.

(2) The "EE" designated units are electrically powered units that have in addition to all of the requirements for the "E" units, the electric motors and all other electrical equipment completely

enclosed. In certain locations the "EE" unit may be used where the use of an "E" unit may not be considered safe.

(3) The "EX" designated units are electrically powered units that differ from the "E" and "EE" units in that the electrical fittings and equipment are so designed, constructed and assembled that the units may be used in certain atmospheres containing flammable vapors or dusts.

(4) The "G" designated units are gasoline powered units having minimum acceptable safeguards against inherent fire hazards.

(5) The "GS" designated units are gasoline powered units that are provided with additional safeguards to the exhaust, fuel and electrical systems. They may be used in some locations where the use of a G unit may not be considered safe.

(6) The "LP" designated units are similar to the "G" units except that they are liquefied petroleum gas engine powered instead of gasoline powered.

(7) The "LPS" designated units are units similar to the "GS" units except that liquefied petroleum gas is used for fuel instead of gasoline.

(8) The "D" designated units are units similar to the "G" units except that they are diesel engine powered instead of gasoline engine powered.

(9) The "DS" designated units are diesel powered units that are provided with additional safeguards to the exhaust, fuel and electrical systems. They may be used in some locations where a "D" unit may not be considered safe.

(c) In addition to the construction and design safety features required in order to obtain a recognized laboratory type designation, approved power-operated industrial trucks shall have at least the following minimum safety features where applicable:

(1) Power-operated industrial trucks shall be equipped with a warning horn, whistle, or gong, or other device that can be heard clearly above the normal shipboard noises.

(2) Wherever power-operated industrial truck operation exposes the operator to danger from falling objects, the truck shall be equipped with a driver's overhead guard. Where overall height of the truck with forks in the lowered position is limited by head room conditions the overhead guard may be omitted.

NOTE: This overhead guard is only intended to offer protection from the impact of small packages, boxes, bagged material, etc., representative of the job application. It is impractical to build a guard of sufficient strength to withstand the impact of a capacity load since such a guard would constitute a safety hazard because its structure would be so large that it might interfere with good visibility and would weigh so much that it might make the truck top-heavy and unstable.

(3) Power-operated fork lift trucks which handle small objects or unstable loads shall be equipped with a vertical load back rest or rack which shall have height, width and strength sufficient to prevent the load, or part of it, from falling toward the mast when the mast is in a position of maximum backward tilt.

(4) The forks on power-operated fork lift trucks shall be secured to the carriage so that unintentional lifting of the toe shall not occur on such application where this lifting may create a hazard. The factor of safety of forks shall be at least 3 to 1, based on the elastic limit of the material.

(5) Fork extensions or other attachments shall be suitably secured to prevent unintentional lifting or displacement on primary forks.

(6) All exposed wheels shall be provided with guards to prevent the wheels from throwing particles at the operator.

(7) Unless the steering mechanism is of a type that prevents road reactions from causing the steering handwheel to spin, the steering knob, if used, shall be of a mushroom type to engage the palm of the operator's hand, or shall be arranged in some other manner to prevent injury. The knob shall be mounted within the perimeter of the wheel.

(8) All steering controls shall be confined within the clearances of the truck, or so guarded that movement of the controls shall not result in injury to the operator when passing obstructions, stanchions, etc.

**§ 78.80–10 Use of power-operated industrial truck in various locations.**

(a) *Spaces containing explosives.* (1) Except as otherwise provided in this paragraph, power-operated industrial trucks shall not be used in a space in which Class A, Class B, or Class C explosives are stowed.

NOTE: Class A, Class B and Class C explosives are defined in Part 146 of Subchapter N (Dangerous Cargoes) of this chapter.

(2) The Commandant may grant authority for the use of approved power-operated industrial trucks with a recognized testing laboratory designation of EX in spaces in which Class A, Class B or Class C explosives are stowed when it can be shown that such trucks can be used with safety.

(3) In a space in which packaged small arms ammunition without explosive bullets is stowed, only approved power-operated industrial trucks with a recognized testing laboratory designation of EX, EE, LPS, GS and DS may be used for handling cargo including the handling of such packaged small arms ammunition.

(b) *Spaces containing flammable liquids.* (1) In a space in which packaged flammable liquids are stowed, only approved power-operated industrial trucks with a recognized testing laboratory designation of EX, EE, GS, LPS, and DS may be used for handling cargo including the handling of such packaged flammable liquids.

(c) *Spaces containing flammable solids or oxidizing materials.* (1) In a space in which packaged flammable solids or oxidizing materials are stowed, only approved power-operated industrial trucks with a recognized testing laboratory designation of EX, EE, GS, LPS, and DS may be used for handling cargo including the handling of such packaged flammable solids or oxidizing materials.

(2) When flammable solids or oxidizing materials are contained in closed cargo vans or closed containers and no other dangerous cargo is stowed in the hold or compartment, any standard commercial type power-operated industrial truck in safe operating condition and having the minimum safety features of § 78.80–7(c) may be used in the spaces.

(3) When oxidizing materials in bulk are stowed in the holds or compartment, any approved commercial type power-operated industrial truck may be used in the spaces.

(d) *Spaces containing hazardous articles.* (1) In a space in which packaged or baled hazardous articles of a fibrous nature or bulk sulfur are stowed, only approved power-operated industrial trucks with a recognized testing laboratory designation of EX, EE, GS, LPS and DS may be used for handling cargo, including the handling of such packaged or baled hazardous articles of a fibrous nature or bulk sulfur.

(2) When hazardous articles of a fibrous nature are contained in closed cargo vans or closed portable containers and no other dangerous cargo is stowed in the hold or compartment, any standard commercial type power-operated industrial truck in safe operating condition and having the minimum safety features of § 78.80–7(c) may be used in the spaces.

(e) *Spaces containing other dangerous cargoes and hazardous articles.* (1) In a space in which dangerous cargoes or hazardous articles subject to the regulations in Part 146 of this chapter, except those provided for in paragraphs (a), (b), (c) and (d) of this section, any approved power-operated industrial truck may be used to handle cargo including the handling of such dangerous cargoes or hazardous articles.

(f) *Other spaces.* (1) Any standard commercial type power-operated industrial truck in safe operating condition and having the minimum safety features of § 78.80–7(c) may be used in spaces and for handling cargo in spaces not otherwise restricted by regulation in this subpart.

**§ 78.80–15 Special operating conditions.**

(a) Notification shall be given to the master or senior deck officer on board before placing power-operated industrial trucks in use aboard the vessel.

(b) When power-operated industrial trucks are in use on board vessels subject to the regulations in this subchapter, they shall be in a safe operating condition.

(c) Spaces exposed to carbon monoxide or other hazardous vapors from the exhausts of power-operated industrial trucks shall have adequate ventilation. The concentration of carbon monoxide shall be kept below 100 parts per million in the holds and intermediate decks where persons are working. When necessary, portable blowers of adequate size and location shall be utilized.

(d) The parts and/or equipment of any power-operated industrial truck requiring replacement shall be replaced only by parts and/or equipment equivalent in safety when installed with those used in the original design.

(e) Any truck that emits sparks or flames from the exhaust system shall immediately be removed from service, and not again returned to service until the cause for the emission of such sparks or flames has been eliminated.

(f) When the temperature of any part of the truck is found to be in excess of a safe operating temperature, the truck shall be removed from service until such overheating has been corrected.

(g) Operation of trucks shall be halted immediately and the engines or motors secured, whenever an emergency condition arises aboard the vessel.

(h) Operation of trucks shall be halted immediately and the engines or motors secured in the event of breakage or leakage of containers used for the carriage of flammable liquids, flammable solids or oxidizing materials.

(i) The rated capacity of a truck shall at all times be posted on the truck in a conspicuous place and such capacity shall not be exceeded.

(j) At least one approved 2-pound dry chemical hand portable fire extinguisher, or its approved equivalent, shall be affixed to the truck in a readily accessible position or kept in close proximity available for immediate use.

(k) Vessel's fire-fighting equipment, both fixed (where installed) and portable, in vicinity of space being worked shall be kept ready for immediate use.

**§ 78.80–20 Refueling.**

(a) *When permitted.* Power-operated industrial trucks are not permitted to be refueled in the hold of a vessel or on the weather deck except under the following conditions:

(1) Trucks using gasoline as fuel may be refueled in the hold or on the weather deck of a vessel only when such refueling is done with an acceptable portable non-spilling fuel handling system of not over 5 gallons capacity. Transfer of gasoline to these portable non-spilling fuel handling devices is not permitted on board the vessel.

(2) Power-operated industrial trucks using liquefied petroleum gas as fuel may be refueled in the hold or on the weather deck of a vessel only when fitted with removable tanks and provided the hand-operated shut-off valve of the depleted tank is closed and the engine is run until it stalls from lack of fuel before the quick disconnect fitting is opened. In addition, the quick disconnect fitting shall be attached to the fuel tank before the hand-operated shut-off valve is reopened.

(3) Power-operated industrial trucks using diesel oil as fuel may be refueled on the weather deck or in the hold of a vessel by means of portable containers of not over 5-gallon capacity. These trucks may also be refueled on the weather deck of a vessel or portable containers refilled from a larger container provided a suitable pump is used for the transfer operation and a drip pan of adequate size is supplied.

(b) *General requirements.* The following conditions must be met when refueling power-operated industrial trucks in the hold of a vessel or on the weather deck under the circumstances listed in paragraph (a) of this section:

(1) Refueling shall be under the direct supervision of an experienced and responsible person specifically designated for such job by the person in charge of the loading or unloading of the vessel.

(2) No refueling shall be undertaken with less than 2 persons specifically assigned and present for the complete operation, at least one of whom shall be experienced in using the portable fire extinguishers required in the fueling area.

(3) At least one approved 4-pound dry chemical hand portable fire extinguisher, or its approved equivalent shall be provided at the scene of the fueling area. This is in addition to portable extinguisher affixed to the truck in accordance with § 78.80–15(j).

(4) The location for refueling trucks shall be designated by the master or senior deck officer on board the vessel. "No Smoking" signs shall be posted in the area and smoking shall be prohibited.

(5) The location designated for refueling shall be adequately ventilated so as to insure against accumulation of a hazardous concentration of vapors. The ventilation requirements of § 78.80–15(c) when trucks are operating shall also apply when trucks are being refueled.

(6) Truck engines of all trucks in the same hold shall be stopped before any truck in that hold is refueled and before any fuel handling devices or unmounted liquefied petroleum gas cylinders are placed in the hold.

(7) All fuel handling devices and unmounted liquefied petroleum gas containers shall be removed from the hold before any truck engine is started and the trucks again placed in operation.

**§ 78.80–25 Charging or replacing batteries.**

(a) Batteries for electrically-powered industrial trucks and for the ignition systems of internal combustion engine-powered industrial trucks may be changed in the hold of a vessel provided the following conditions are met:

(1) Suitable handling equipment shall be employed.

(2) Adequate precautions shall be taken to avoid damage to the battery, short circuiting of the battery and spillage of the electrolyte.

(b) Batteries of electrically-powered industrial trucks may be recharged in a hold of a vessel provided the following conditions are met:

(1) The batteries shall be housed in a suitable, ventilated, portable metal container with a suitable outlet at the top for connection of a portable air hose, or shall be placed directly beneath a suitable metal hood with a suitable outlet at the top for connection of a portable air hose. The air hose shall be permanently connected to an exhaust duct leading to the open deck and terminate in a gooseneck or other suitable weather head. If natural ventilation is not practicable or adequate, mechanical means of exhaust shall be employed in conjunction with the duct. The air outlet on the battery container shall be equipped with an interlock switch so arranged that the charging of the battery cannot take place unless the air hose is properly connected to the box.

(2) If mechanical ventilation is used, an additional interlock shall be provided between the fan and the charging circuit so that the fan must be in operation in order to complete the charging circuit for operation. It is preferable that this interlock switch be of a centrifugal type driven by the fan shaft.

(3) The hold shall not contain any cargo coming under the regulations in Part 146 of Subchapter N (Dangerous Cargoes) of this chapter.

(4) The charging facilities may be part of the truck equipment or may be separate from the truck and located inside or outside the cargo hold. The supply or charging circuit (whichever method is used) shall be connected to the truck by a portable plug connection of the break-away type. This portable plug shall be so engaged with the truck battery charging outlet that any movement of the truck away from the charging station will break the connection between the plug and receptacle without exposing any live parts to contact with a conducting surface or object, and without the plug falling to the deck where it may become subject to injury.

(c) All unmounted batteries shall be suitably protected or removed from an area in the hold of the vessel before trucks are operated in that area.

**§ 78.80–30 Stowage of power-operated industrial trucks aboard a vessel.**

(a) Power-operated industrial trucks may be stowed in any location aboard a vessel provided the following conditions are met:

(1) Gasoline powered trucks shall have all the fuel expended from the system.

(2) Liquefied petroleum gas powered trucks shall have the fuel tanks removed and all the fuel expended from the system.

(b) Power-operated industrial trucks not meeting the conditions set forth in paragraph (a) of this section shall be stowed on the open deck except for intervals such as lunch hours, between work shifts, interdock and intraport movements. If stowed in a fixed metal enclosure located on or above the weather deck, such enclosure shall have access from the weather deck only and shall have adequate ventilation, so ar-